Phase III Remedial Action Plan – RTN 4-601
Former Aerovox Facility
New Bedford, MA

Prepared for

AVX Corporation, Fountain Inn, SC

August 2016

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List of Abbreviations

ACO	Administrative Consent Order (DEP)
amsl	above mean sea level
AOC	Administrative Order on Consent (EPA)
AST	Aboveground Storage Tank
AUL	Activity and Use Limitation
bgs	below ground surface
CEP	Critical Exposure Pathway
COCs	Constituents of Concern
CSA	Comprehensive Site Assessment
CVOCs	Chlorinated Volatile Organic Compounds
cy	cubic yards
DNAPL	Dense Non-aqueous Phase Liquid
EPA	U.S. Environmental Protection Agency
FPRS	Free Product Recovery System
gpd	gallons per day
gph	gallons per hour
IRA	Immediate Response Action
ISCO	In situ Chemical Oxidation
ISI	Initial Site Investigation
lf	linear feet
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MHW	Mean High Water
MIP	Membrane Interface Probe
MiHpt	Membrane Interface Hydraulic Profiling Tool
NAPL	Non-aqueous Phase Liquid
NTCRA	Non-Time-Critical Removal Action
OHM	Oil or Hazardous Material
OU	Operable Unit
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PRB	Permeable Reactive Barrier
RAP	Remedial Action Plan
RAPS	Response Action Performance Standards
SARA	Superfund Amendments and Reauthorization Act of 1986
sf	square feet
SEE/CA	Supplemental Engineering Evaluation and Cost Analysis
TCE	Trichloroethene
TSCA	Toxic Substances Control Act
TSDF	Treatment, storage and/or disposal facility
UCL	Upper Concentration Limit
UVOST	Ultraviolet Optical Screening Tool

Section 1

Introduction

1.1 Scope of Phase III Remedial Action Plan

The Phase II Comprehensive Site Assessment (Phase II CSA) for the former Aerovox Facility concluded that comprehensive remedial actions are necessary for the Site to achieve a Condition of No Significant Risk. Under the Massachusetts Contingency Plan (MCP) 310 CMR 40.0850, the Phase III Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives (Phase III) is based on the findings of the Phase II CSA and Method 3 Risk Assessment contained therein. The MCP requires the following as part of the Phase III:

- Initial screening of likely remedial action alternatives;
- Detailed evaluation of Remedial Action Alternatives using a comparison of the effectiveness, short-term and long-term reliability, difficulty of implementation, cost, risks, benefits, timeliness in eliminating uncontrolled sources of oil and/or hazardous materials (OHM), and effect upon non-pecuniary interests of the remedial action alternatives;
- Evaluation of the feasibility of each of the potential remedial action alternatives, including the feasibility of implementing the alternative, reducing concentrations of OHM to background or levels approaching background and below upper concentration limits (UCLs), eliminating, preventing or mitigating Critical Exposure Pathways (CEP) (if applicable), and eliminating or controlling each source of contamination, contaminant migration, and non-aqueous phase liquid (NAPL); and
- Preparation of a Phase III Remedial Action Plan (Phase III RAP) documenting the evaluation and selection of the Comprehensive Remedial Action(s).

1.2 Purpose and Organization

The purpose of the Phase III process is to identify, through the screening and evaluation process, remedial options for the Disposal Site that have a high probability of achieving a condition of No Significant Risk, resulting in a Permanent Solution, or where a Permanent Solution is not feasible, a condition of No Substantial Hazard, resulting in a Temporary Solution. To that end, this Phase III RAP is divided into five main parts consisting of one or more sections in the document:

- Summary of Site background information related to the occurrence, assessment and delineation of the release, basis of design and identification of preliminary remedial goals;
- Documentation of the Phase III process, including an initial screening of remedial technologies, a detailed evaluation of identified remedial action alternative(s), selection of the remedial action alternative(s) and feasibility evaluation of the selected remedial action alternative(s);
- Proposed schedule, including projected timeframes for achieving a Permanent or Temporary Solution and implementation of the remedial action alternative(s);
- Phase III Completion Statement; and,
- Summary of public notification requirements and activities.

Section 2

Site Description and History

2.1 Agreements

Ongoing work at the former Aerovox Facility is being conducted under Massachusetts General Law Chapter 21E and the MCP. Assessment and remediation of the Site is also subject to the June 3, 2010 Administrative Consent Order and Notice of Responsibility (identified as ACO-SE-09-3P-016 and referred to herein as the ACO), between AVX Corporation (AVX) and the MassDEP and Massachusetts Office of the Attorney General. Three modifications to ACO-SE-09-3P-016 have been authorized by MassDEP, including the following:

- On February 27, 2015, AVX requested a six-month extension to the submittal of the Phase II CSA as a result of issues with obtaining access to a property north of the Precix property, which was required for delineation of the bedrock groundwater contaminant plume. This request was authorized by MassDEP in a March 10, 2015 Amendment to the ACO.
- As part of the MassDEP's review and approval of the Phase II CSA, ACO Amendment #2 was issued, changing the Phase III RAP submission date to July 11, 2016.
- On June 20, 2016, AVX requested an extension to the July 11, 2016 Phase III RAP submittal date, and MassDEP ACO Amendment #3 extending the Phase III RAP deadline to August 22, 2016 is pending.

In addition to the ACO, work at the Site is subject to the Administrative Order on Consent (AOC) between the United States Environmental Protection Agency (EPA) and AVX, and the Cooperation and Settlement Agreement between the City of New Bedford (property owner) and AVX. The effective date of these documents is also June 3, 2016, and initiation of work under the ACO was based on completion of the Work under the EPA AOC.

2.2 Site Description

The former Aerovox Facility (the Facility) is located at 740 Belleville Avenue, Bristol County, New Bedford, Massachusetts (the Property). Figure 2-1 provides the location of the Site on the United States Geological Survey (USGS) topographic map for New Bedford, Massachusetts. The coordinates of the Site (referenced to the corner of Belleville Avenue and Hadley Street) are latitude 41° 40' 25.12" N and longitude 70° 55' 13.84" W (UTM coordinates 340135.53m E and 4615326.34m N).

The Property is industrially-zoned land that was formerly occupied by a 450,000 square foot manufacturing building, associated ancillary buildings, asphalt paved parking lot and several small landscaped areas. The manufacturing building (the main building) consisted of a 2-story building (the western section), and a 3-story building (the eastern section). The exterior walls of the main building were constructed of brick and the roof was constructed of wood. The first floor, which was the building foundation floor, was constructed of concrete; the second floor consisted of both concrete and wood; and, the third floor was constructed of wood. Ancillary structures included a brick boiler house that was attached to the south side of the main building; a brick sewer pump station located south of the main building; a pump station located along the Acushnet River shoreline; and, a brick electrical switching equipment building located near the southwest corner of the main building along Hadley Street. All Facility infrastructures on the Property were demolished and removed in 2011 as part of a Non-Time-Critical Removal Action (NTCRA) and pursuant to the EPA AOC. After demolition of the buildings, an asphalt cap was installed across the site, except for the northwest corner. This area was left as a green space for public use.

Industrial properties are present to the south and north of the Property, and residences are located to the west, across Belleville Avenue. The Acushnet River borders the eastern end of the Property. The Acushnet River and the area below Mean High Water (MHW) east of the Site is part of the New Bedford Harbor Superfund Site.

The MCP defines the Disposal Site as "…any structure, well, pit, pond, lagoon, impoundment, ditch, landfill or other place or area, excluding ambient air or surface water, where uncontrolled oil and/or hazardous material have come to be located as a result of any spilling, leaking, pouring, abandoning, emitting, emptying, discharging, injecting, escaping, leaching, dumping, discarding or otherwise disposing of such oil and/or hazardous material." Polychlorinated Biphenyls (PCBs) and/or Chlorinated Volatile Organic Compounds (CVOCs) have come to be located in soil and groundwater outside of the Disposal Site boundaries originally defined in the ACO, which were generally defined by the Property boundaries. Based on the Phase II CSA findings, the current Disposal Site boundaries are identified as follows:

- The eastern Disposal Site boundary remains unchanged from the ACO definition and is the existing sheet pile wall (inclusive of the wall itself) running generally in a north-south orientation along the Acushnet River, and the line formed by the elevation of MHW where the sheet pile wall is not present.
- The western Disposal Site boundary is approximately 115 feet east of and parallel to the western property line along Belleville Avenue;
- The northern Disposal Site boundary extends northeast from the western Disposal Site boundary across the northern abutting property occupied by Precix, Inc. and onto the former Coyne Industrial Laundry property. Approximately 125 feet north of the Precix Property line, the Disposal Site Boundary turns east, extending to the Acushnet River.
- The southern Disposal Site boundary extends southeast from the western Disposal Site boundary to a point approximately 265 feet south of the southern Aerovox property boundary, then turns northeast paralleling the shoreline until it intersects with the eastern property line.

Refer to Figure 2-2 for the Site Plan, for a graphical depiction of the former main building footprint and the extent of soil and groundwater contamination defining the Disposal Site boundaries as they are currently delineated.

2.3 Site History

Electrical component manufacturing began at the Facility in approximately 1938. Use of PCB containing dielectric fluid in capacitor manufacturing started in the 1940s and was terminated in 1978. Dielectric fluids were stored in above ground storage tanks (ASTs) throughout the building, but mainly in the first floor of the 2-story section of the main building. There was no secondary containment associated with the PCB ASTs.

Aerovox also used solvents in the manufacturing process, including trichloroethene (TCE). The TCE was used in a capacitor degreasing operation and was stored in an AST located in the second floor of the two-story building, just outside of the impregnation room. The TCE recovery system ASTs were located in the first floor of the 3-story building, and degreasing residues were stored in 55-gallon drums on a concrete floor, reportedly with no secondary containment. Note that the Precix facility on the northern abutting property also historically used TCE for manufacturing operations. The TCE used by Precix was stored in an AST located directly north of the location of the former Aerovox ASTs.

The use of PCBs in the manufacturing process ceased around October 1978; however, the use of solvents continued through the end of manufacturing operations at the facility. Operations and disposal practices involving the use of PCBs and solvents reportedly resulted in the release of hazardous materials. Records indicate that EPA observed “oil impregnated soil…in the culverts leading to and at both outfalls” during a 1981 compliance inspection of the facility. Culvert, as used here by EPA is believed to refer to the open drainage trenches that were adjacent to and ran parallel to the north and south sides of the three-story section of the building. In addition to the oily soils observed in the drainage trenches, EPA observed oily soils in the “backyard power substation” located between the former Aerovox building and the Acushnet River. Samples collected from the soils within these two areas contained PCB concentrations of up to 24,000 parts per million (ppm). EPA noted that the backyard power substation was reportedly used for drum storage within the month prior to EPA’s collection of the samples and historic aerial photographs reviewed by EPA (dating back to 1951) also indicated probable storage of drums in this area.

Subsequent facility inspections, assessments and sampling programs were undertaken by the former owner and operator, Aerovox, Inc., as well as by EPA from the 1980s through 2010. These investigations confirmed the presence of PCBs in building materials, soils under the concrete foundation and outside the building, in the asphalt used to pave the parking lot and in groundwater.

In 2010, the consent agreements were signed, requiring AVX Corporation to complete a NTCRA to demolish the buildings and cap the Property. The consent agreements, and the Action Memorandum for the NTCRA, included a Toxic Substance Control Act (TSCA) Determination which documented work at the Site as meeting the requirements of a TSCA risk based approval under 40 CFR 761.61(c). NTCRA work included preparation, submittal, and approval of the EPA required work plans and completion of field activities to decommission site utilities, demolish the buildings and transport the waste for off-site disposal at a permitted TSCA facility, and temporarily cap the Site with a 3-inch asphalt cap. Field activities for the NTCRA were initiated in April 2011 and completed in December 2011. The final report documenting the NTCRA was submitted in May 2012 and approved by EPA in May 2013. The deadlines identified in the ACO between AVX and MassDEP were based upon EPA’s approval of the NTCRA final report. Therefore, AVX’s receipt of EPA’s approval letter triggered initiation of the MCP Phase I Initial Site Investigation (Phase I ISI).

AVX submitted a Phase I ISI, Tier Classification, and Phase II Scope of Work in August 2013. At the time of the Phase I ISI, the Disposal Site boundaries were identified as the property boundaries, with the exception of the eastern boundary, which was defined as the existing sheet pile wall (inclusive of the wall itself) running generally in a north-south orientation along the Acushnet River, and the line formed by the elevation of MHW where the sheet pile wall is not present. The Disposal Site was ranked as Tier 1B based on the Numerical Ranking System in place at the time. MassDEP issued the Tier 1B Permit for the Site and approved the Phase II Scope of Work in September 2013, triggering the Phase II CSA submittal requirement.

During the period between October 2013 and August 2015, Site investigation activities associated with the Phase II CSA were completed to define the nature and extent of contamination at the Site. Investigation activities completed as part of this assessment included a seismic refraction survey to determine the depth and configuration of the bedrock surface; high resolution site characterization using membrane interface probe and hydraulic profiling tool (MiHpt) and ultraviolet optical screening tool (UVOST) to evaluate the presence and extent of dissolved contamination and potential Dense Non-aqueous Phase Liquid (DNAPL); direct push soil borings were advanced to collect soil samples for chemical analysis as part of soil contaminant delineation, and monitoring wells were installed in the shallow overburden, deep overburden, and bedrock aquifers to delineate groundwater contamination. The Phase II CSA confirmed soil and groundwater contaminants of concern (COCs) at the Disposal Site to be PCBs and CVOCs, including chlorinated benzenes and chlorinated ethenes. Both the PCBs and chlorinated benzenes were components of the dielectric fluid used as in capacitor manufacturing, and the chlorinated ethenes are due to the use of TCE (and to a lesser extent tetrachloroethene (PCE)) as a solvent, and the reductive dechlorination breakdown (daughter) products of TCE.

During the course of Phase II CSA activities, dense non-aqueous phase liquid (DNAPL) was identified in two monitoring wells (MW-15B/MW-15D) in the northeast corner of the Property. The presence of DNAPL constitutes a MCP reporting condition, and DNAPL recovery activities are ongoing.

2.4 Current Conditions

The Aerovox property, owned by the City, is currently predominantly paved and partially fenced. A small unpaved corner remains in the northwest corner as public space and the fence does not extend across the waterfront along the east side. The western portion of the paved area is separated from the remainder of the property by jersey barriers and is used by the City for parking. The Titleist and Precix properties, to the south and north respectively, are active manufacturing facilities and operate multiple shifts seven days a week. The Coyne Laundry property is closed, fenced and locked and has recently been sold after Coyne went through bankruptcy proceedings.

2.4.1 Conclusions of Phase II CSA

Based on the results of the Phase II CSA (AECOM, September 2015) investigations and evaluations completed, the following conclusions have been documented. Refer to Figure 2-2 for sampling locations referenced below.

- The hazardous materials found in Site media include PCBs, chlorinated benzenes, and chlorinated ethenes.
- The primary source of contaminants at the Site was the dielectric fluids used in capacitor manufacturing and chlorinated solvents used for cleaning and degreasing operations. These sources were reportedly released through improper storage and disposal practices, direct discharge, and from spills and releases from overfilling the raw material ASTs.
- PCBs released at the Site are largely adsorbed to surface soils. However, PCBs and CVOCs have also migrated from their original release locations downward and resulted in dissolved groundwater contamination and the presence of DNAPL. Groundwater analytical data indicate that CVOCs have a degraded into daughter products, and the plume is considered late-stage.
- PCBs are ubiquitous across the Property and the riverfront portion of the Titleist property. Shallow soil above the identified peat layer was found to be impacted with PCBs along the Precix and Titleist riverfronts, with concentrations on the Titleist property exceeding the UCL. Deep soils in the vicinity of the identified DNAPL area (MW-15D) and a limited area of soils centered around boring B04B also exceeded the PCB UCL.
- Chlorinated ethenes are present in the 3 feet to 15 feet soil profile below the former Aerovox building foundation, in the south central area of the Property and within the northeast corner of the Property. In general, higher TCE concentrations are detected in deeper soils, with the exception of the TCE concentration at 3.5 feet bgs in boring B04B. The soil interval between 15 feet bgs down to the bedrock surface has a higher concentration of TCE detections in the eastern half of the Property. TCE is the only chlorinated ethene exceeding its UCL, which occurs both in the northeast corner of the Property and in the vicinity of UV-17.
- PCB impacts to shallow overburden groundwater are limited to a small area along the waterfront near the southern culvert discharge location. PCB impacts to deep overburden groundwater extends from the center of the Property to the shoreline, with PCB concentrations increasing toward the river. PCB impacts in deep overburden groundwater extend partially onto the northeast corner of the Titleist property, and low levels of PCBs in deep overburden groundwater were also found in two

wells on the south side of the Precix property. PCB impacts to bedrock groundwater are present in wells across the eastern two thirds of the Property, with the highest concentrations centered around the central release area (B04B) and along the waterfront. Bedrock groundwater concentrations in the northeast corner, in the area of identified DNAPL, exceed the groundwater UCL for PCBs.

- The extent of chlorinated ethenes in shallow and deep overburden groundwater extends across most of the Property, the southern and eastern half of the Precix property and the northeast portion of the Titleist property. The highest TCE concentrations in shallow groundwater were detected in samples collected from monitoring wells along Graham Street and at the discrete central (B04B) area on the Property. Deep overburden chlorinated ethene concentrations on average are one to two orders of magnitude higher than shallow overburden concentrations; however, neither shallow nor deep overburden groundwater concentrations for TCE exceed UCL levels.
- Chlorinated ethene impacts to bedrock groundwater extend across all but the westernmost portion of the Property and extend southerly along the waterfront to the southern end of the Titleist property and northward beneath the Precix property and onto the Coyne property. The highest TCE concentrations in bedrock groundwater are above the UCL, and are present in the deepest fracture zone encountered in the center of the Property (MW-26B), in the deep fracture zone of MW-34B in the northeast corner of the Property, and in the shallow bedrock groundwater associated with the DNAPL area (MW-15B). (Note that carbon tetrachloride was also found above UCL levels in the northernmost bedrock well, MW-24B on the Precix property. This is not a constituent related to or originating from the Aerovox releases.)
- TCE is the dominant detected chlorinated ethene and has a heightened potential for impacting receptors via indoor air; therefore, the presence of TCE in the shallow groundwater adjacent to the Precix and Titleist buildings each required a vapor intrusion evaluation. The evaluation indicated that vapor intrusion is not a pathway of concern for Titleist. The vapor intrusion pathway is complete for Precix, but does not present a risk under current site uses.
- A peat layer of varying thickness is present across much of the eastern portions of the Site. The sheet pile wall that defines the eastern edge of the Property was keyed into this peat layer to impede the migration of contaminants within shallow groundwater and from shallow soils into the river. However, contaminants in deep overburden groundwater and at the overburden bedrock interface migrate with tidal flow both toward and away from the river.
- Groundwater flow in deep overburden and in bedrock is strongly influenced by the tides, reversing flow direction in response to the tidal cycle. The change in flow direction is exhibited most strongly at the shoreline in the deep overburden and bedrock aquifers. Due to the presence of the sheet pile wall, the shallow overburden aquifer has a limited response.
- A strong interconnection exists between the shallow overburden, deep overburden and shallow bedrock aquifers, and between groundwater and surface water of the Acushnet River. Vertical groundwater gradients exist between the three aquifers, and vary between positive (upward) and negative (downward). Where tidal influence on groundwater levels is greatest, reversals in vertical gradient from positive to negative are observed with changing tides. Further inland, these vertical gradients are largely positive, and the magnitude of the gradient is observed to change with the tidal cycle. Based on data collected for the multi-level bedrock sampling devices, a positive vertical gradient is observed in shallow bedrock, whereas negative vertical gradients are observed in deeper bedrock sampling intervals.
- Observed DNAPL is limited in extent, present only in monitoring wells MW-15B/MW-15D in the northeast corner of the Property near the sheet pile wall. It is present at depth and likely originated both from the northern culvert discharges and from PCB containing oils released from capacitors dumped near the shoreline. The DNAPL contains both PCBs and chlorinated solvents. Based on soil concentrations and UVOST screening results, DNAPL may also be present in shallow soil above the

peat layer near the south culvert, and if present in this location, is presently contained by the HAC cap and sheet pile wall.

- The Method 3 Risk Assessment (Method 3) calculated human health risks for current and foreseeable future uses for identified receptors and exposure scenarios. The Method 3 also evaluated Risk to public safety and welfare and included a Stage 1 Environmental Screening. The Method 3 Risk assessment found a condition of No Significant Risk does not exist for the site, as summarized below:
  - Concentrations in surface soil on the Titleist property present unacceptable chronic non-cancer and cancer risks for various current (employee, trespasser) and future (potential residential) exposure scenarios. (The access control measures that are in place for this area have mitigated any sub-chronic or acute potential impacts until final response actions can be implemented)
  - Under current conditions, the non-cancer risks and incremental lifetime carcinogenic risks for the Precix property are within acceptable limits for employees. However, the non-cancer and cancer risks for foreseeable future conditions are above acceptable limits for hypothetical residents who could be exposed to CVOCs in indoor air via inhalation.
  - The Method 3 results indicate that non-cancer and cancer risks are within acceptable limits for future construction work on the western side of the Property. The non-cancer and cancer risks are above acceptable limits for future construction work within the eastern half of the Property and in the central area surrounding boring B04BN.
  - The presence of PCBs and TCE concentrations in soil above UCLs across some areas of the Property present a risk to public welfare. Additionally, the average concentration of PCBs in groundwater in the vicinity of the DNAPL area (MW-15B) exceeds the UCL.

The Stage I Environmental Screening indicated that groundwater concentrations have the potential to impact surface water above available criteria and MassDEP benchmarks for the Acushnet River[1]. However, the foreseeable migration of groundwater contaminants to surface water is valid if and only to the extent that the Site could act as a continuing source to the river after both MCP Phase IV (at the Site) and EPA CERCLA (at the NBH Superfund Site) response actions are complete.

2.4.2 Remedy Implementation Under IRA

On April 10, 2014, MassDEP was notified of the presence of DNAPL at a measured thickness of greater than 0.5-inch in monitoring well MW-15D, and an Immediate Response Action (IRA) Plan was submitted in June 2014 to address the presence of the DNAPL. The objective of the IRA Plan when submitted was to recover DNAPL to the extent feasible, delineate DNAPL at the Site, and design, install and operate a DNAPL recovery system as an interim measure until the final Site remedy was selected. Delineation of the DNAPL occurred concurrent with the Phase II CSA, and included MiHpt advancement and UVOST evaluations, each followed by advancement of soils borings and collection of soil samples for laboratory analysis. Gauging of monitoring wells MW-15B and MW-15D under the IRA Plan was initiated on May 19, 2014. After ten months and 18 gauging events (through the end of March 23, 2015), the average volume recovered from MW-15D was 136 milliliters (ml). After the first twelve recovery events, the volume of DNAPL recovered during each event decreased, and with two exceptions, has been less than 100 ml, averaging 39 ml per event. Through the recovery event on July 20, 2016, approximately 3,313 ml (0.84 gallon) of DNAPL have been recovered from MW-15D. DNAPL thickness in MW-15D has

[1] The Acushnet River is part of the New Bedford Harbor (NBH) Superfund Site, and remedial goals for PCBs were established by EPA in the NBH ROD documents. EPA did not establish criteria for chlorinated ethenes, so Method 1, GW-3 Standards are considered as a reference for these constituents.

decreased from the initial measurement of 7 inches to non-measurable during the last three gauging events.

On September 19, 2014, DNAPL was observed for the first time in MW-15B, and gauging and recovery of DNAPL from MW-15B was initiated on September 22, 2014. The average volume recovered from MW-15D between September 29, 2014 and March 23, 2015 was 76 milliliters (ml). Subsequently, the trend of DNAPL recovery volume has decreased, and similar to recovery volumes for MW-15D, all but two recovery volumes have been less than 100 ml. The average recovery event DNAPL volume is 40 ml. The recovery event on July 20, 2016, approximately 1,810 ml (0.39 gallons) of DNAPL were recovered from MW-15B. DNAPL thickness in MW-15B has fluctuated between a maximum of 5.5 inches and a minimum thickness of 0.51, with an overall decreasing trend.

In January 2016, as a result of the decrease in DNAPL recovery the gauging and recovery event frequency was reduced to once per month. However, MassDEP has since requested that the recovery event frequency be increased to every other week, which was initiated on July 7, 2016.

MassDEP asserted that a condition of Substantial Release Migration (SRM) exists at the Site and requested submittal of an IRA Plan Modification to contain or remove the DNAPL to prevent further migration to the river. Specifically, on March 11, 2016 MassDEP sent AVX correspondence requiring submittal of an IRA Modification by April 15, 2016 that would include “measures to contain or remove the DNAPL to prevent further migration to the Acushnet River which otherwise meets the requirements of 310 CMR 40.0424, including a detailed schedule for the proposed response actions.”

On April 14, 2016, AVX submitted an IRA Plan Modification with the objective of removing recoverable DNAPL from: shallow and deep overburden, and shallow bedrock in the vicinity of MW-15; in the vicinity of UV-17 from soils above the peat layer; and, in the vicinity of MIP-23 from soils above the peat layer. These IRA activities are ongoing as of August 2016.

A free product recovery system (FPRS) will be installed in the vicinity of MW-15. The FPRS in the shallow overburden and shallow bedrock in the vicinity of MW-15 will be passive systems, primarily due to the limited areal extent of known DNAPL. The target interval for the shallow passive FPRS will be the overburden materials immediately over the peat layer and the peat layer itself, and the shallow bedrock FPRS will target the depth interval between 20 to 50 feet below mean sea level (msl), which corresponds to the screened interval of MW-15B. Both of these recovery wells will be fitted with solid bottom sumps and belt skimmers to remove DNAPL from the water column and from the bottom sumps.

In light of the negligible amount of NAPL being recovered from the existing well MW-15D, the deep overburden FPRS will be an active system such that the potential for DNAPL recovery is maximized. The system will incorporate groundwater extraction and re-infiltration to create artificial gradients that may be capable of inducing migration of mobile DNAPL in this area toward the extraction well. The recovery well design will incorporate a sump to collect DNAPL that settles by gravity. The FPRS will be operated until diminished recoveries are observed. Based on the volume of DNAPL pumped to date during recovery events, the FPRS is not anticipated to recover appreciable amounts of DNAPL. Once diminishing recovery has been observed, the recovery well will be converted to a passive system. Note that a plan view and cross sections of the MW-15 area have been included in Appendix A. These figures show the integration between the existing IRA FPRS and the selected remedial action alternative for the Aerovox property.

DNAPL removal in the vicinity of UV-17 and MIP-23 will be completed through excavation and offsite disposal of impacted soils. In May 2016, a soil boring program was undertaken to further define the extent of DNAPL impact in these areas, as well as collected soil samples for waste characterization. Excavation dewatering will take place to allow for excavation to just beneath the peat layer, per MassDEP’s direction. Dewatering liquids will be collected in a frac tank, characterized for waste profiling and disposal, and disposed off-site. Excavated soils will be live-loaded into roll off containers and transported for off-site disposal at a licensed facility. If possible, a marker layer will be placed within the excavation, backfilled with clean backfill material and compacted. After compaction, the excavation areas will be paved with an asphalt mixture having a very low permeability that is the equivalent to the original hydraulic asphalt concrete (HAC) cap.

Section 3

Basis of Design and Preliminary Remedial Goals

Remedial action objectives consist of specific goals for protecting health, safety, public welfare and the environment. These objectives will guide the development and evaluation of remedial action alternatives for the Site. The performance standards for Phase III evaluation [310 CMR 40.0853] require that remedial action alternatives be identified and evaluated that are "reasonably likely to achieve a level of No Significant Risk", and that the recommended alternative be a Permanent Solution or a Temporary Solution. "No Significant Risk", as defined in the MCP [310 CMR 40.0006], is "a level of control of each identified substance of concern at a Site or in the surrounding environment such that no such substance of concern shall present a significant risk of harm to health, safety, public welfare or the environment during any foreseeable period of time." A Permanent Solution is any measure or combination of measures which will, when implemented, ensure attainment of No Significant Risk. Permanent Solutions must also include measures that reduce the levels of oil and hazardous materials in the environment to as close to background as feasible. A Temporary Solution is any measure, or combination of measures, which will, when implemented eliminate any Substantial Hazard which is presented by a Disposal Site until a Permanent Solution is achieved. A Temporary Solution can be selected if a Permanent Solution is not currently feasible or response actions to achieve a Permanent Solution are feasible and shall be continued toward a Permanent Solution.

3.1 Operable Units (OUs)

For the purpose of evaluating remedial actions, the Site has been divided into four operable units (OUs) for remediation based on the media and identified exposure pathways where the Method 3 Risk Characterization identified the presence of Significant Risk to human health and/or the environment and a Risk to Public Welfare. These include:

1. The current and future risk associated PCBs in the uncapped soils between the ground surface and an identified peat layer on the east end of the Titleist property, identified as OU1;
2. Potential vapor intrusion associated with CVOC contaminated groundwater in shallow overburden in Hadley Street adjacent to Precix (OU2);
3. Contact with overburden soil above UCLs, migration of deep overburden groundwater contamination to the Acushnet River (including zones of contamination above the UCLs) and migration of contamination to the Acushnet River through on site storm sewers (collectively, OU3); and,
4. Migration of bedrock contamination across the east half of the Disposal Site to the Acushnet River OU4).

3.2 Impacted Shallow Uncapped Soils - OU1

Operable Unit 1 (OU1) consists of surface soils above the peat layer within the eastern landscaped area of the Acushnet/Titleist property. These soils are believed to have been impacted through migration of contaminated sediment during flooding episodes from Site drainage. A 36-inch storm sewer traverses west to east down the length of Hadley Street, discharging to the Acushnet River. This segment of the storm sewer derives flow from the City of New Bedford storm sewer within Belleville Avenue and drainage from two catchment areas on the Aerovox property itself. In addition, Hadley Street is sloped downward toward the east, and surface runoff is directed eastward to the end of Hadley Street, near the Acushnet River shoreline. During significant storm events, especially during a concurrent high tide, flooding of the Site and Hadley Street occurs. As a result, the Phase II Scope of Work (Phase II SOW) included evaluation of potential impacts to landscaped area soils on the east end of the Titleist property resulting from potential transport of impacted sediment through Property catch basins and flooding of Hadley Street. In December 2013, 10 hand auger soil borings were advanced on the east end of the Titleist property. The samples were collected from the depth interval between the ground surface and 2 feet bgs, and submitted for analysis of PCBs.

The analytical data for these samples indicated total PCB concentrations ranging from 0.51 mg/kg in the westernmost soil boring (B04.5E) to 533 mg/kg in the easternmost soil boring (B08.5F). Based on these concentrations, an Imminent Hazard evaluation was completed. The IH evaluation considered employees, landscapers, and trespasser exposure scenarios, and concluded that an IH was not present.

In 2014, 18 additional soil borings were advanced at locations around and between the hand auger borings to delineate the lateral impact in the area. In 17 of these borings, soils were collected in 2 foot intervals down to the identified peat layer. The soils samples were submitted for PCB analysis, and analyzed iteratively, beginning with the 0-2 foot interval. If analysis of the 0-2 foot interval at any location indicated the presence of PCBs at a concentration greater than 1.0m g/kg, the next depth interval would be analyzed for PCBs. In this manner, PCB concentrations were delineated vertically across the area.

Subsequently, to further reduce potential risk posed by the PCB contaminated soils, access restrictions were put in place, including extending existing fencing to completely enclose the area with PCB concentrations above 1 mg/kg and placement of a geotextile fabric marker layer and 6 inches of clean crushed gravel over areas where vehicles and personnel were known to frequent for facility maintenance activities, for the purpose of minimizing the potential to spread PCB contamination beyond the boundaries of the known contamination. The fenced areas are locked to prevent unauthorized access.

The Method 3 Risk Assessment for this area of the Disposal Site indicated that non-cancer and cancer risks are unacceptable for current employees and trespassers exposure scenarios and future potential residential exposure scenarios. The TSCA Determination for the Site, part of the AOC NTCRA Action Memorandum, provided that areas of the Site where soil or asphalt PCB concentrations are above 2 mg/kg be covered with an asphalt cap to meet the requirements of a TSCA risk based approval under 40 CRF 761.61(c). The asphalt cap specified in the Action Memorandum[2] includes placement of a visual barrier, followed by placement of a 2-inch asphalt binder coarse and a 1-inch asphalt wearing course. The MCP standard for PCBs for unrestricted use is 1 mg/kg.

- The preliminary remedial goals for the Titleist property are to:
- Eliminate or reduce concentrations, to the extent feasible, or control access to areas with soils with contaminant concentrations greater than their respective UCLs (surface soils with PCB concentrations > 100 mg/kg); and,
- Eliminate or reduce, to the extent feasible, or control access to surface soils that present unacceptable risk under current or foreseeable future Site use.

3.3 Vapor Intrusion Pathway – OU2

Operable Unit 2 (OU2) consists of the potential vapor intrusion pathway for the Precix property where the lines of evidence, including CVOC-contaminated shallow overburden groundwater above GW-2 standards beneath Graham Street adjacent to the building, subslab soil gas above screening values beneath the

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[2] Refer to Section VI(B)(1)(b) of the Action Memorandum for specified cap requirements.

existing building and indoor air concentrations of CVOCs found in select building areas, suggest a complete vapor intrusion pathway. Three monitoring wells in Graham Street are completed within the shallow aquifer (groundwater within 15 feet of the ground surface) and within 30 lateral feet of the Precix building, identified as: MW-4S, MW-16S and MW-18S. Three CVOCs, TCE, cis-1,2-dichloroethene, and vinyl chloride, exceed the Method 1 GW-2 standard in groundwater samples collected from at least one of these three wells. The TCE Method 1 GW-2 standard of 5 ug/l has been exceeded in monitoring wells MW-4S, MW-16S, and MW-18S. TCE concentrations range from 20 ug/l to 47 ug/l in MW-4S; 170 ug/l to 380 ug/l in monitoring well MW-16S; and, 200 ug/l to 1,500 ug/l in monitoring well MW-18s. The concentration of vinyl chloride in groundwater samples collected from monitoring well MW-4S range from 2.5 ug/l to 17 ug/l, above the 2 ug/l Method 1 GW-2 Standard for this compound. Similarly, the cis-1,2-dichloroethene concentration detected in groundwater samples collected from MW-18s range from 53 ug/l to 690 ug/l, above the Method 1 GW-2 standard of 20 ug/l.

Upon review of the groundwater sampling data from the March 2014 event, a survey of the Precix building was completed with the purpose of identifying locations for installation of subslab soil vapor probes. In May 2014, four subslab soil vapor probes were installed. After an equilibration period, four subslab soil vapor samples and co-located indoor air samples, as well as an ambient air sample, were collected. A second round of samples was collected in December 2014, during the heating season to account for the effect of potential seasonal variations on subslab and indoor air concentrations.

The data was compared to the subslab soil gas screening values and indoor air threshold values within the 2011 MassDEP *Interim Final Vapor Intrusion Guidance* and the October 2014 MassDEP *Draft Vapor Intrusion Guidance: Public Review Draft (collectively, the VI Guidance).* The screening indicated that TCE exceeds the residential and commercial/industrial screening value in samples collected from each subslab vapor point during both rounds of sampling. Although tetrachloroethene (PCE) was not detected in groundwater above GW-2 standards, PCE concentrations exceeded the residential screening value in samples collected from two locations during the first sampling event, and the commercial/industrial screening value was exceeded in the sample collected from a third location during the second sampling event. The cis-1,2-dichlroethene concentration exceeded the residential value at one location during the first sampling event.

Indoor air sample data indicated that TCE was detected at indoor air sampling locations at concentrations above the residential and commercial/industrial threshold value during the first sampling event. The samples from only one of these locations exceeded the threshold value. PCE was also detected at concentrations above the VI Guidance residential screening criteria in samples collected from two locations during the first sampling event and one location during the second.

Based on the vapor intrusion evaluation, the indoor air samples indicated that the concrete slab significantly impedes CVOC vapor intrusion into the building itself. While subslab soil gas concentrations beneath the Precix building were significant as compared to MassDEP screening values, sufficient attenuation is observed under current conditions, and the indoor air concentrations are not greater than the MassDEP imminent hazard or more urgent response values for TCE (per the August 2014 MassDEP TCE Toxicity Fact Sheet). Indoor air concentrations for other constituents are not above threshold values published in the VI Guidance.

The preliminary remedial goals for OU2 relative to the vapor intrusion pathway are to:

- Reduce CVOC groundwater and subslab soil gas concentrations, to the extent feasible, and control these media as potential sources for vapor intrusion in GW2 areas; and,
- Mitigate or control subsurface migration of CVOCs and vapor intrusion to occupied buildings in GW-2 areas so that indoor air concentrations do not exceed risk based levels for the foreseeable future use.

3.4 Source Area Overburden Groundwater and Soils – OU3

Operable Unit 3 (OU3) is the source control OU, and is comprised of the Aerovox Property soils, storm sewers, and overburden groundwater. The Phase II CSA confirmed the ubiquitous presence of PCBs in soil at varying concentrations across the Property. Shallow soils along the riverfront and deeper soils in the northeast corner of the Property exhibited PCB concentrations above UCLs. Within the soil profile from three feet bgs down to bedrock, chlorinated ethenes are present in soil across the eastern portion of the property and more prevalent in deeper inaccessible soils. TCE is the only chlorinated ethene exceeding its UCL, and this occurs both in the northeast corner of the Property and along the riverfront in the vicinity of UV-17. The UV-17 area soils will be removed upon completion of the ongoing IRA.

In addition to soil contamination, sediments present within the catch basins draining the Property contain PCB concentrations ranging from 4 mg/kg to 696 mg/kg. A video survey of the drainage lines indicates that cracks and breaches in the drainage lines allow groundwater infiltration to occur. In addition, there are a number of structural issues such as crushed sections of pipe, corrosion of corrugated metal pipes, and severe degradation and loss of mortar along the brick drainage line.

Groundwater analytical data indicated that deep overburden groundwater exceeds the Method 1 GW-3[3] standard for PCBs and TCE. Based on the Phase II CSA hydrogeological analysis, there is a strong interconnection between overburden groundwater and the Acushnet River, which may result in discharge of Site groundwater contaminated above these standards to the river.

The preliminary remedial goals for OU3 are to:

- Eliminate or reduce concentrations, to the extent feasible, or control access to the areas with soils containing contaminants at concentrations greater than their respective UCLs;
- Eliminate or reduce, to the extent feasible, or control access to soils that present unacceptable risk to human health and/or the environment;
- Eliminate or reduce, to the extent feasible, or control soil as a potential source of impacts to overburden GW;
- Reduce concentrations, to the extent practicable, and control migration of overburden GW impacted by PCBs and/or CVOCs at concentrations that could migrate into and present a risk to receptors in surface water and sediment after New Bedford Harbor remediation is complete;
- Eliminate, to the extent feasible, and control DNAPL in overburden that may be a source of impacts to overburden GW or that may be non-stable; and,
- Eliminate, to the extent practicable, and control the migration of PCB impacted sediments in the Site storm water system.

3.5 Site Wide Bedrock – OU4

Operable Unit 4 (OU4) consists of the impacted bedrock groundwater at the Site. Analytical data indicate that shallow bedrock groundwater exceeds the Method 1 GW-3 standards for PCBs and TCE as shown on Figure 2-8 and 2-11 of the Phase II CSA, respectively. In addition, UCLs for PCBs and TCE are exceeded in the shallow bedrock groundwater in northeast corner of the Property in the vicinity of MW-15B (DNAPL has also been detected in MW-15B). In the deeper bedrock (below 50 feet), groundwater analytical data indicate GW-3 standards are exceeded for TCE in the vicinity of MW-26B, MW-32B, and MW-34B. UCLs for TCE are exceeded in deep bedrock groundwater in MW-26B and MW-34B, with the highest concentrations detected between 170 feet and 180 feet below grade in MW-34B. Geophysical logging

[3] The Phase II CSA included a Method 3 Risk Characterization and Stage 1 Ecological Risk Assessment. Method I GW-3 Standards are referenced here for comparison purposes. Standards for PCBs in the River were historically established through the EPA CERCLA ROD for the New Bedford Harbor Superfund Site. The EPA ROD did not establish standards for TCE.

conducted as part of the Phase II CSA has indicated no flow or very low flow in bedrock water-bearing fractures at depths below approximately 185 feet.

The remedial action goals for the shallow and deep bedrock groundwater at the Site (OU4) are to:

- Reduce concentrations of CVOCs and PCBs in bedrock groundwater where they exceed corresponding UCLs;
- Eliminate, to the extent feasible, and control the migration of DNAPL in fractured bedrock that may be a source of impacts to groundwater or that may be non-stable;
- Achieve a stable or contracting plume in bedrock groundwater; and
- Reduce concentrations of CVOCs and PCBs in bedrock groundwater, to the extent practicable.

3.5.1 Mass Flux Evaluation

To support the evaluation of potential remedial action alternatives, Brown and Caldwell conducted a mass flux evaluation to assess the potential impacts of Site-related constituents discharging from the bedrock water-bearing fractures to the Acushnet River. The Phase II CSA (AECOM, September 2015) indicated that groundwater flow in the bedrock water-bearing fractures is generally from west to east toward the Acushnet River. Although groundwater flow in the bedrock is affected by the tidally influenced river level (causing flow direction reversals during incoming (high) tide), the net direction of groundwater flow (and therefore net direction of dissolved contaminant migration) is towards the River. To be conservative, the goal of this mass flux evaluation was to estimate the concentration of site-related constituents in the pore water within the sediments underlying the River (where benthic organisms are potential receptors) resulting from the migration of groundwater in bedrock to these sediments, rather than assessing the concentrations in surface water after they have been diluted by the flow into the River. This evaluation provides a basis for determining the level of cleanup required in the bedrock groundwater to achieve a level of No Significant Risk. The calculations used to perform this mass flux evaluation are included in Appendix B.

The evaluation was conducted by estimating the rate at which a mass of Site-related constituents dissolved in groundwater may be contributed to the pore water beneath the Acushnet River, *i.e.*, the mass flux of constituents from bedrock groundwater to the pore water, and the resulting concentrations in the pore water. This approach is consistent with that described in "Groundwater Remediation Strategies Tool" (American Petroleum Institute Publication 4730, December 2003). The equation for calculating the mass flux of a constituent is:

$$mf = \Sigma\, C_i q_i A_i$$

Where: mf = total mass flux from bedrock water-bearing fractures (µg/sec)

C_i = concentration of the constituent (µg/mL=µg/cm^3)

q_i = specific discharge through the flow area (cm/sec),

where: q_i=Ki, with K= hydraulic conductivity (cm/sec) and i=hydraulic gradient (cm/cm)

A_i = flow area perpendicular to flow (cm^2),

where: A_i=(L)(b), with L=width of constituent plume perpendicular to flow and b=saturated thickness of zone

In applying this evaluation to the Site, the mass flux was calculated across a cross-sectional flow area of the bedrock interval containing water-bearing fractures with Site-impacted groundwater and positioned at the down gradient border of the Site, adjacent to the river, aligned perpendicular to groundwater flow (which in this case is typically parallel or sub-parallel to the shore line). This cross sectional area is shown on the figure included in Appendix B (the cross section is a modification of cross section C-C' from Appendix R of the Phase II CSA that has been extended vertically to show the full depth of deep bedrock monitoring wells MW-32B and MW-34B). The vertical dimension of the flow area is equal to the saturated thickness (b) of bedrock water-bearing fractures to the depth where very little or no flow in bedrock was encountered (discussed below). The horizontal dimension of the flow area, L, is equal to the width of the plume for the Site constituent (TCE) that has the greatest width exceeding GW-3 standards (470 feet). Because the concentrations of constituents vary along the flow area, the flow area was divided into two horizontal zones with concentrations of similar magnitude. The horizontal limits of these zones were defined by the midpoint between bedrock wells MW-07B and MW-34B, with the northern zone extending to the northern boundary of the Site, and the southern zone extending approximately 40 feet beyond the southern boundary of the Site (to account for the maximum width of the bedrock plume as delineated in the shallow bedrock as shown on Figure 2-11 of the Phase II CSA). Within each of these two zones, the vertical thickness of the bedrock was further subdivided into two depth intervals based on available bedrock concentration data. For the northern zone, this subdivision was at a depth of 160 feet, with the shallower bedrock characterized by an average bedrock concentration of 72,800 ug/l within this depth interval, and the deeper bedrock zone characterized by an average concentration of 483,330 ug/l. For the northern zone, heat pulse flow meter (HPFM) data presented on the geophysical logs in Appendix G of the CSA showed very low flow in bedrock below a depth of 180 feet in MW-34B (it is noted that the deepest bedrock monitoring well at the Site (MW-33B) was drilled to a depth of 255 feet and the HPFM data for that well showed no flow below a similar depth of 185 feet). For the southern zone, the vertical subdivision was at a depth of 125 feet, with the shallower bedrock characterized by an average concentration of 7,040 ug/l, and the deeper bedrock characterized by an average concentration of 26,500 ug/l. HPFM data showed no flow in bedrock well MW-32B below a depth of 159 feet.

Estimating the horizontal hydraulic gradient in the bedrock water-bearing fractures is complicated by the reversal in flow directions caused by tidal fluctuations on the eastern half of the property. The horizontal gradient was estimated by taking the mean of the difference between the horizontal gradient toward the River observed during low tide (Figure 2-16 of the CSA), and the landward horizontal gradient observed during high tide (Figure 2-19 of the CSA). This results in a net horizontal hydraulic gradient toward the River of 0.00012 cm/cm.

The geophysical logs of the deep bedrock wells included in Appendix G of the Phase II CSA identified three types of fractures which were characterized as:

- Minor fracture (not distinct and may not be continuous around the borehole);
- Intermediate fracture (distinct and continuous around the borehole with little or no apparent aperture); and,
- Major fracture (distinct and continuous around borehole with apparent aperture).

These descriptions (combined with a review of the HPFM data) indicate that only the major fractures are likely to transmit significant quantities of groundwater and site-related constituents. This interpretation is supported by the review of the caliper logs which indicate that essentially all of the significant enlargements of the boreholes are associated with the identified major fractures (as shown on the figure included in Appendix B, the majority of these significant fractures were targeted for placement of FLUTe® multi-port liner sampling ports). Based on these data, there are large intervals within the deep bedrock which contain no significant fractures and are characterized by no flow or very low flow. Therefore, the saturated thickness (b) used to calculate bedrock flow was the thickness of the well screens and FLUTE® sampling ports.

Separate mass flux calculations were made for each of the four cross sectional sub-areas described above. These calculated values were then added together to arrive at an estimate of total mass flux for the flow area in the bedrock at the down gradient side of the Site.

The concentration of site-related constituents in the pore water in sediments beneath the Acushnet River was estimated assuming that bedrock groundwater flow from the Site discharges to the overlying outwash deposits and sediment within an area that in an east-west direction extends from the river shore adjacent to the site to the middle of the river, and in a north-south direction extends across the width of the plume. Within this area, groundwater flows upward through the outwash deposits to the River (similar flow from uplands on the east side of the River is anticipated to discharge to the eastern half of the River). The vertical discharge of bedrock groundwater through the outwash deposits was calculated as follows:

$$Q_{vow} = (K_{vow})\ (i_{vow})\ (X * L)$$

Where:

Q_{vow} = Vertical discharge through outwash deposits (cm^3/sec)

K_{vow} = Vertical hydraulic conductivity of outwash deposits (cm/sec)

I_{vow} = Vertical hydraulic gradient from top of bedrock to bottom of River (dimensionless)

X = One-half width of River (feet)

L = Width of bedrock plume (feet)

The horizontal hydraulic conductivity of the deep overburden outwash deposits was characterized in the Phase II CSA as 126.2 feet per day, or 0.044 cm/sec. The vertical hydraulic conductivity of these deposits was assumed to be one-tenth of the horizontal hydraulic conductivity (a typical ratio for sedimentary deposits), or 0.0044 cm/sec. The vertical hydraulic gradient was estimated using hydraulic heads from monitoring well couplets on the western portion of the Site (MW-13D/B, MW-21D/B and MW-101S/B) which are not subject to the large tidal fluctuations observed in monitoring wells near the River. The average of the upward vertical hydraulic gradients observed in these wells was 0.0023. One-half the width of the River (305 feet) was estimated using the midpoint of the average width of the River measured opposite the northern border of the Site, the middle of the Site, and the southern border of the Site. The width of the plume at the Site boundary (470 feet) was described above.

The concentration of bedrock groundwater constituents in the outwash deposits under the River (and therefore in the pore water) adjacent to the Site was calculated as follows:

$$C_{ow} = (Mf_{br})\ (1/\ Q_{vow})$$

Where:

C_{ow} = Concentration of constituent in outwash deposits and pore water (ug/cm^3)

Mf_{br} = Mass flux of constituent from bedrock groundwater (ug/sec)
Q_{vow} = Vertical discharge through outwash deposits (cm^3/sec)

To address some of the uncertainties in this evaluation, conservative assumptions were made in the above-described calculations which result in pore water concentration estimates that are biased high. These assumptions are as follows:

- The hydraulic conductivity used for the bedrock water-bearing fractures was the average from slug tests in the shallow bedrock (34.9 feet/day) as identified in Section 2.2.3.3 of the Phase II CSA. However, hydraulic conductivity typically decreases with depth in bedrock and therefore the use of hydraulic conductivity estimates from shallow bedrock wells likely overestimates the average hydraulic conductivity of the deeper bedrock water-bearing fractures. Because greater hydraulic conductivity estimates (used to calculate specific discharge through the flow area) results in greater estimated mass flux, the use of biased-high hydraulic conductivity estimates is conservative.

- The upward vertical gradient from the bedrock to the river was estimated using well couplets on the western side of the Site. However, the net upward vertical gradient is likely greater beneath the river (the regional discharge zone). A greater upward vertical gradient would result in a greater vertical discharge through the outwash under the river and thus a lower estimated concentration in the outwash deposits and pore water of the river sediments
- The mass flux calculations were based on recent groundwater sampling results included in the Phase II CSA. It is noted that targeted treatment of the bedrock groundwater to reduce groundwater concentrations below UCLs will be performed as part of the Comprehensive Response Action. Conducting the mass flux calculations using concentrations of less than 50,000 ug/l (anticipated after treatment of the UCL areas), decreases the mass flux by nearly one-half.
- The mass flux calculations did not include any adjustments to account for the attenuation of contaminant concentrations which will occur as the plume flows (laterally and vertically) from the deep bedrock water-bearing fractures through the outwash deposits to the River. This is may be a significant factor, particularly in the vicinity of monitoring well MW-34B where the highest concentrations (likely indicative of NAPL) were detected in the lowest sampling port, and concentrations decrease by nearly an order of magnitude moving upward in the bedrock well to the shallowest sampling port (possibly caused by attenuation).

To screen for potential impacts to the ecological receptors, the estimated pore water concentrations in sediment beneath the River were compared with Method 1 GW-3 standards. The mass flux analysis was conducted for TCE because this constituent is the most widespread and has been detected at the highest concentrations in bedrock water-bearing fractures (including exceedances of UCLs in several bedrock wells). Although PCBs have been detected above UCLs in one bedrock well (MW-15B), PCBs have much lower mobility and therefore were not considered a driver for the mass flux calculations. (In addition, the UCL exceedance for PCBs in MW-15B is associated with a localized NAPL condition in that well that is being addressed by the IRA described above.) The Method 1 GW-3 standard for TCE is 5,000 ug/l and is meant to be protective of all surface water in Massachusetts. Based on the mass flux calculation for TCE migrating from the bedrock water-bearing fractures, the resulting concentration of TCE in the pore water in sediment beneath the river is calculated at approximately 1,393 ug/l. Given the number of conservative assumptions that were used in these calculations, it is anticipated that the actual concentration in the pore water is significantly lower. As a result, Brown and Caldwell concludes that active remediation of the bedrock water-bearing fractures, to reduce concentrations in pore water in the sediments beneath the river, is not required. Remedial actions will be implemented in the bedrock, and will address the exceedances of UCLs that occur in bedrock in order to achieve a Permanent Solution.

The feasibility of reducing groundwater concentrations in bedrock to achieve or approach background is evaluated in Section 7.1.

Section 4

Development of Remedial Alternatives

4.1 Initial Screening of Remedial Technologies (310 CMR 40.0856)

The purpose of the initial screening phase is to determine which technologies are to be retained for further evaluation in accordance with the criteria in 310 CMR 40.0855(2)(a). The criteria require that technologies be screened and retained for those that are likely to achieve a level of No Significant Risk. The categories of remedial technologies/response actions were divided by Site media. A brief description of the categories of remedial technologies and remedial action alternatives are presented in the following sections and summarized in Table 4.1.

4.1.1 Soil

4.1.1.1 In-situ Soil Treatment

In-situ soil treatment includes the treatment of soils for reduction of COCs in place (i.e., excavation of soils is not required). The specific types of technologies that may be implemented in-situ include bioremediation, chemical oxidation, soil solidification/stabilization, thermal treatment and air sparging/SVE.

None of the in-situ treatment technologies has been retained, as each is unlikely to achieve the reduction of COC concentrations required for a Permanent Solution, largely due to the difficulties associated with Site conditions. The potential presence of DNAPL, proximity to the Acushnet River, heterogeneous subsurface conditions and variable groundwater elevations create limitations for these technologies. In addition, three of the technologies are not effective for PCBs, and thermal treatment requires a higher temperature for PCBs and has the added disadvantage of high energy use.

4.1.1.2 Ex-situ Soil Treatment

Ex-situ soil treatment includes excavation and treatment of COCs using a treatment method, including bioremediation, chemical oxidation, thermal treatment, or soil washing. Ex-situ biological treatment and chemical oxidation are effective for CVOCs, do not depend on off-site disposal, and use of these technologies ex-situ results in more control over amendment distribution. Chemical oxidation requires management, storage and handling of hazardous chemicals at the Site, and neither of these two treatment technologies is proven effective for PCBs. Soil washing is complicated to implement, generates an additional waste stream, and requires that the soil be disposed after treatment. Ex-situ biological, chemical and thermal treatment may achieve a permanent solution for OU3A and have been retained for further evaluation.

4.1.1.3 Soil Containment

Containment consists of placement of a physical barrier that prevents contact with impacted soil and source material. The advantages of a cap are that handling and excavation of contaminated soil is not required, and there is a low degree of difficulty to implement. An AUL is required for use of a cap or engineered barrier containment, and long-term maintenance would be required. Containment technologies are readily available and reasonably likely to achieve a Permanent Solution for the Site. Containment has been retained for OU1 and OU3A.

4.1.1.4 Soil Excavation and Off-site Disposal

Excavation and off-site disposal involves excavating contaminated soils and/or source material and disposing of generated wastes off-site. There is a low degree of difficulty to implement this technology, and use results in a decreased mass and volume remaining on-site. There are disadvantages associated with soil excavation and off-site disposal including risks associated with material handling and transportation, generation of an excavation dewatering waste stream, and excavation cannot be used to remove contamination beneath the buildings or in deep soils. Excavation and disposal is a readily available technology and is reasonably likely to achieve a Permanent Solution for OU1 and OU3A. This technology has been retained.

4.1.1.5 Soil Excavation and On-site Consolidation

Excavation and on-site consolidation includes excavation of impacted soils from the Aerovox and Titleist properties, consolidation of the soils on the Aerovox property, and placement of an engineered barrier over the soils. This technology has the same advantages as excavation and disposal, and also has the benefit of removing the risk of transportation of contaminated material to an off-site disposal facility. Excavation and on-site consolidation has been retained for OU1 and OU3A because it is a technology that is readily available and is reasonably likely to achieve a Permanent Solution.

4.1.1.6 Activity and Use Limitation

An AUL is a legal document recorded with the deed and tied to the property that specifies allowable uses, prohibited uses, and ongoing maintenance requirements associated with any engineered controls (caps, engineered barriers, vertical containment barriers, etc.). The City of New Bedford has already agreed to an AUL for the Aerovox property, if necessary for a condition of No Significant Risk and a Permanent Solution for the Site. Use of an AUL on the Precix or Titleist properties will require agreement of the existing property owners. Use of an AUL is reasonably likely to achieve a Permanent Solution in conjunction with one or more of the other identified technologies, and therefore, has been retained for OU1, OU2, and OU3A.

4.1.2 Groundwater

4.1.2.1 Containment

Containment of groundwater functions to isolate contaminated groundwater and prevent migration of contaminants off-site. Contaminant technologies that were screened include vertical barriers, bedrock jet-grouting, and hydraulic containment using groundwater extraction. Vertical barriers are proven technologies with a low degree of difficulty to implement and are effective for contaminated overburden groundwater.

Jet-grouting the top of the bedrock surface involves injection of a cementitious mixture into the subsurface to fill groundwater transmitting fractures and voids to mitigate migration. This technology is applicable for shallow bedrock, and may reduce, but not completely prevent upward migration of contaminated groundwater from the bedrock aquifer. This technology is available, but not likely to achieve reduction of COCs to desired concentrations due to difficulty of implementing this technology in complex Site conditions such as those represented by the type of bedrock at the Site and proximity to the Acushnet River.

Hydraulic containment and ex-situ treatment (pump and treat) includes extraction and treatment of groundwater to capture groundwater contaminants and prevent off-site migration. This technology is proven, has a low degree of difficulty to implement, and is effective for both overburden and bedrock groundwater.

Due to the availability of vertical barrier and hydraulic containment technologies, and the reasonable likelihood that they can achieve a Permanent Solution in conjunction with other technologies, they have been retained for OU3B.

4.1.2.2 Treatment

Groundwater treatment technologies, similar to soil treatment technologies, include in-situ bioremediation, chemical oxidation, and thermal treatment, as well as installation of a permeable reactive barrier and monitored natural attenuation. Both bioremediation and chemical oxidation rely heavily on obtaining a successful distribution of the amendments and proximity of impacted groundwater to the Acushnet River and site heterogeneous subsurface conditions pose difficulties for obtaining the needed distribution. Similarly, location of the Site will result in high energy costs for thermal treatment due to the supply of water from the river to the treatment zones. All six of these technologies are readily available and may achieve a Permanent Solution. In-situ biological and chemical treatment, permeable reactive barrier, and monitored natural attenuation have been retained for OU3B, and in situ chemical treatment, in-situ thermal treatment, and monitored natural attenuation have been retained for OU4.

4.1.3 Soil Gas

Vapor mitigation includes the implementation of measures designed to eliminate or mitigate the vapor intrusion pathway by either preventing the migration of vapors into buildings or treating air inside the buildings. Selection of the best approach depends on consideration of a variety of building construction and Site characteristics, as well as the magnitude of the indoor air impact.

4.1.3.1 Monitored Attenuation

Monitored attenuation for soil gas includes uses indoor air and subslab soil gas monitoring on an on-ongoing basis to record changing conditions over time. This technology has a low degree of difficulty of implementation, and ongoing indoor air monitoring will provide information to determine whether the status on whether the Condition of No Significant Risk for current occupants has changed, or if additional mitigation would be required in the future. This technology may achieve a Permanent Solution in conjunction with selected remedies for OU3 source control. This technology has been retained for OU2.

4.1.3.2 Vapor Barrier

A vapor barrier could be installed over the first floor of the building. This would include sealing cracks and penetrations in the floor, and placement of a membrane over the entire section of the building floor where vapor migration is of concern. This technology can be moderately difficult to implement, and does not mitigate the source; however, it would provide a Permanent Solution for vapor migration to indoor air if combined with an AUL, and has been retained for OU2.

4.1.3.3 Subslab Depressurization System

There are two options for a subslab system to mitigate soil vapors. A passive subslab system would provide a pathway for discharge of vapors from beneath the building by installing a vent that discharges above the roof of the building. Differences in pressure gradients would create passive ventilation of the subslab area. This type of system has low maintenance requirements and a low degree of difficulty to implement. Similarly, an active subslab system includes installation of a vent system and discharge piping, but uses a blower to assist in removal and discharge of vapors. An active system is generally more effective in reducing subslab soil vapor concentrations. Neither passive nor active systems are effective in saturated conditions or with a minimal vadose zone thickness. The technology for these systems is readily available, and the active subslab depressurization system has been retained for OU2.

4.1.3.4 Activity and Use Limitation

An AUL is a legal document that specifies allowable uses, prohibited uses, and ongoing maintenance requirements associated with any engineered controls, including Active Exposure Pathway Mitigation Measures. Use of an AUL on the Precix property will require agreement of the existing property owners. An AUL is reasonably likely to achieve a Permanent Solution in conjunction with one or more of the other identified technologies, and therefore, has been retained for OU2.

4.1.4 NAPL

4.1.4.1 Excavation

Excavation of soils containing DNAPL is effective for removal of contaminant mass and volume and has a low degree of difficulty to implement. Disadvantages are similar to those outlined for soil excavation. Since excavation technology is readily available and likely to achieve a Permanent Solution for overburden soils in combination with other technologies, this technology has been retained for OU3A.

4.1.4.2 Free Product Recovery and Off-site Disposal

This technology involves installation of a FPRS to remove mobile DNAPL to the extent feasible. A FPRS is being installed as an IRA modification for the northeast corner of the Site. If proven effective for removal of DNAPL under site conditions, the system could be enhanced/enlarged to maximize recovery volume. There is a low degree of difficulty to implement this technology, which is readily available and reasonably likely to achieve a Permanent Solution in combination with other technologies. Installation of a FPRS has been retained for OU3A.

4.1.5 Mitigation of Contaminant Migration through the Storm Sewer

Two technologies are available for mitigation of the potential for contaminants in groundwater and sediment within storm water to migrate from the catch basins and drainage pipes to the Acushnet River. These technologies are removal and replacement of the storm sewer lines, or cleaning and lining the existing storm sewer. Each of these technologies will provide successful removal of contaminants in catch basins and lines, and would mitigate or reduce infiltration of contaminated groundwater. These technologies are both available, reasonably likely to achieve a Permanent Solution in combination with other technologies, and have been retained for OU3A.

4.2 Summary of Remedial Alternatives

The initial technology screening presented in Sections 4.1 and 4.2 provides the basis for development of the remedial action alternatives for each OU. The technologies retained are those that are reasonably likely to be feasible and achieve either a Temporary or a Permanent Solution. The retained technologies were considered alone or in combination to form a range of alternatives for each OU to be evaluated against the criteria in the MCP (310 CMR 40.0858), including effectiveness, reliability, difficulty of implementation, costs, risks associated with implementing the remedial alternative, benefits, timeliness, and non-pecuniary interests. An evaluation of the OU alternatives including cost estimates is presented in Section 5.

The alternatives represent a range of remedial options that are reasonably likely to be feasible, achieve a level of No Significant Risk, and effectively achieve the established remedial action objectives. The horizontal limits and/or vertical depths of the retained remedial technologies were established based on the analytical laboratory results for site soils and groundwater presented in the Phase II Comprehensive

Site Assessment dated September 18, 2015. The alternatives developed for each OU are described in the sub-sections below.

4.2.1 OU1

OU1 consists of PCB-contaminated soils located above the peat layer on the eastern side of the Titleist property. Four remedial action alternatives were developed for OU1 and will be retained for detailed evaluation. The four alternatives are:

- OU1-1: Excavation of 2 Feet of Surface Soil and All Soils with PCB Concentrations Greater Than the PCB UCL of 100 mg/kg;
- OU1-2: Excavation of All Soils with PCB Concentrations Greater Than 4 mg/kg;
- OU1-3: Excavation of All Soils with PCB Concentrations Greater Than 1 mg/kg;
- OU1-4: Placement of an Engineered Barrier or Asphalt Cap over All Soils with PCB Concentrations Greater Than 100 mg/kg and 1 mg/kg, respectively.

The alternatives for OU1 are summarized on Table 4.3.1. A description of each potential remedial action alternative is presented below.

Alternatives OU1-1, OU1-2 and OU1-3 involve the excavation of PCB-impacted soils. All three alternatives include transportation to and disposal at an approved off-site disposal facility or consolidation beneath an engineered barrier constructed over targeted areas of OU3A. The engineered barrier is a containment technology that has been retained for one of the OU3A remedial alternatives. For cost estimating purposes, all soils excavated from OU1 are assumed to be transported to and disposed of at an approved off-site disposal facility.

In order to perform the excavations for Alternatives OU1-1, OU1-2 and OU1-3, the remedial contractor would be required to obtain a Trench Permit from the City of New Bedford taking the following factors into consideration:

- OSHA regulations require benching, sloping, or other excavation support to safely excavate to depths of five feet bgs or greater;
- Excavation activities would occur adjacent to the existing Titleist building;
- Groundwater in the vicinity of the excavation areas is tidal and may be encountered for deeper parts of the excavations.

Soils with PCB concentrations above the unrestricted reuse criteria that are not removed as part of Remedial Action Alternatives OU1-1, OU1-2 and OU1-4 would be covered by a cap or engineered barrier. The layer components and thicknesses vary between alternatives based on the concentrations of PCB-impacted soils remaining on site. The cap or engineered barrier would be designed to provide separation and prevent exposure of site workers and visitors to the remaining impacted soils.

Following the remedial construction of any alternative, a Final Inspection Report would be completed to document the soil excavation, disposal or consolidation, and cap installation. Additionally, a Permanent Solution Statement would be filed at the conclusion of the remedial actions for the Site.

An AUL would be filed following the remedial construction of Alternatives OU1-1, OU1-2 and OU1-4. The AUL would require continued monitoring, maintenance and documentation of the cap and repairs as necessary, limitations that prohibit residential use of the property, and mandate the use of a Soil Management Plan and Health and Safety Plan to mitigate potential direct contact with impacted soils that remain on-site. Because OU1-4 includes an Engineered Barrier, routine inspection reporting and establishment of a Financial Assurance Mechanism would also be required.

Alternative OU1-1

The major components of Alternative OU1-1 are:

- Excavation and removal of soils which have PCB concentrations greater than 100 mg/kg;
- Excavation and removal of the top two feet of soils which have PCB concentrations greater than 1 mg/kg;
- Transportation and disposal of PCB-impacted soils at an approved off-site facility or consolidation of PCB-impacted soils beneath an Engineered Barrier on the Aerovox property;
- Installing a demarcation layer;
- Backfilling excavation areas with imported clean backfill and soil cap installation;
- Restoring the ground surface in kind (landscaping);
- Placing an AUL on the impacted portions of the property restricting foreseeable future use; and,
- Performing ongoing monitoring, maintenance and documentation of the soil cap integrity and repairs (as necessary to maintain compliance with the AUL).

This alternative includes excavation of approximately 6,600 cubic yards of PCB-impacted soils to depths of between two feet and five feet bgs. The approximate horizontal limit of this alternative's excavation areas are presented on Figure 4.3.1-1.

Since this alternative involves excavation to a depth of 5 feet bgs. in only limited areas, dewatering is not anticipated, assuming that the deeper excavations can be performed during low tide.

This alternative would require annual monitoring and documentation of the soil cap, and repairs as necessary. This alternative does not require operation of treatment technology or any other equipment. This alternative would require EPA approval of a cap configuration that differs from that described in the EPA TSCA Determination, because the EPA TSCA Determination contained within the AOC required capping of all soils with PCB concentrations > 2 ppm with a visual barrier and three inches of asphalt. Note that EPA's original April 2006 Supplemental Engineering Evaluation and Cost Analysis (SEE/CA) included as a requirement for the site a cover that shall function as a barrier to direct contact exposure to contaminated site soils, shall be as protective as possible and shall at a minimum consist of twelve inches of vegetated soil. While this OU1-1 RAA allows for a thicker (deeper) protective cover than that required in EPA's original SEE/CA, it also reduces concentrations in the upper two feet to 1 mg/kg, resulting in a more protective alternative than that chosen by the SEE/CA.

Alternative OU1-2

The major components of Alternative OU1-2 are:

- Excavation and removal of soils which have PCB concentrations greater than 4 mg/kg;
- Transportation and disposal of PCB-impacted soils at an approved facility or consolidation of PCB-impacted soils beneath an engineered barrier on the Aerovox property;
- Installing a demarcation layer;
- Backfilling excavation areas with imported clean backfill and soil cap installation;
- Restoring the ground surface in kind;
- Placing an AUL on the impacted portions of the property restricting foreseeable future use; and,
- Performing ongoing monitoring, maintenance and documentation of the soil cap integrity and repairs (as necessary).

This alternative includes excavation of approximately 7,300 cubic yards of PCB-impacted soils to depths of between two feet and six feet bgs. The approximate horizontal limits of this alternative's excavation areas are presented on Figure 4.3.1-2.

For the purpose of cost estimating, it is assumed that interlocking steel sheet piles will be utilized for excavation support and groundwater control in the deeper areas of the excavations.

This alternative would require annual monitoring and documentation of the soil cap, and repairs as necessary. This alternative does not require operation of treatment technology or any other equipment. This alternative would require EPA approval of a cap configuration that differs from that described in the EPA TSCA Determination, which required capping of all soils with PCB concentrations greater than 2 ppm with a visual barrier and three inches of asphalt.

Alternative OU1-3

The major components of Alternative OU1-3 are:

- Excavation and removal of soils which have PCB concentrations greater than 1 mg/kg;
- Transportation and disposal of PCB-impacted soils at an approved facility or consolidation of PCB-impacted soils beneath an engineered barrier on the Aerovox property;
- Backfilling excavation areas with imported clean backfill; and,
- Restoring the ground surface in kind.

This alternative includes excavation of approximately 9,400 cubic yards of PCB-impacted soils to depths of between two feet and seven feet bgs. The approximate horizontal limits of this alternative's excavation areas are presented on Figure 4.3.1-3.

For the purpose of cost estimating, it is assumed that interlocking steel sheet piles will be utilized for excavation support and groundwater control in the deeper areas of the excavations. Excavation dewatering is assumed.

Since this alternative removes all soils with PCB concentrations greater than unrestricted use risk based concentrations, no AUL would be placed on the site.

Alternative OU1-4

The major components of Alternative OU1-4 are:

- Installing a demarcation layer;
- Constructing an engineered barrier over soils with PCB concentrations greater than 100 mg/kg;
- Construction a minimum 3-inch thick pavement cap over soils with PCB concentrations greater than 1 mg/kg;
- Placing an AUL on the impacted portions of the property restricting foreseeable future use; and,
- Performing ongoing monitoring, maintenance and documentation of the engineered barrier and pavement cap integrity and repairs (as necessary).

This alternative includes containment of PCB-impacted soils by either an engineered barrier or a pavement cap. The approximate horizontal limits of these are presented on Figure 4.3.1-4.

This alternative would require annual monitoring and documentation of the soil cap, and repairs as necessary. A financial assurance mechanism will be required for engineered barrier maintenance. This alternative does not require operation of treatment technology or any other equipment. Because the pavement cover meets the requirements of the EPA TSCA Determination, additional EPA approval would not be required.

4.2.2 OU2

OU2 is limited to the potential vapor intrusion pathway for the Precix property where the lines of evidence, including CVOC-contaminated shallow overburden groundwater above GW-2 standards beneath Graham Street adjacent to the building, subslab soil gas above screening values beneath the existing building and indoor air concentrations of CVOCs found in select building areas, suggest a complete vapor intrusion pathway. Under current commercial/industrial site uses, a condition of No Significant Risk exists, but changes in foreseeable future site use may change risk assumptions. Three remedial action alternatives were developed for OU2 and will be retained for detailed evaluation. The three alternatives all include and AUL and the monitored natural attenuation of contamination beneath the existing building which will be affected by the selection of a remedial alternative for OU3B (Aerovox property overburden groundwater) that controls or eliminates the adjacent CVOC contamination on the Aerovox property. The three alternatives are:

- OU2-1: Monitored Subslab Soil Gas Attenuation and an AUL;
- OU2-2: Monitored Natural Attenuation of Subslab Soil Gas, an AUL and Installation of a Vapor Barrier Over the Floor Slab; and,
- OU2-3: Monitored Natural Attenuation of Subslab Soil Gas, Installation of an Active Subslab Depressurization System (SSDS) and an AUL.

The alternatives are summarized on Table 4.3.2. A description of each potential remedial action alternative is presented below.

The existing building currently houses an active, multi-shift manufacturing business. Alternatives OU2-2 and OU2-3 involve the installation of vapor mitigation measures inside of the building and would require coordination with the existing business schedule of the building owner. Likely, this would require implementation of these two remedial alternatives on weekends and holidays.

The current OU2 conditions, including subslab constituent concentrations and attenuation afforded by the present building slab, result in indoor air concentrations that satisfy a condition of No Significant Risk for current commercial/industrial uses. As such, all of the considered alternatives employ natural degradation processes to address contamination below the Precix building floor slab. Natural degradation is comprised of several different physical, chemical, and biological processes which, under favorable conditions, act to reduce the mass, toxicity, and mobility of subsurface contamination. Natural degradation is an intrinsically slow process. It may require a period of up to or more than thirty years (the timeframe typically used for cost comparison of alternatives) to reduce TCE concentrations in soil and groundwater to levels where a condition of No Significant Risk would be achieved for unrestricted foreseeable future use including residential use.

For each alternative, long-term monitoring would continue until the data demonstrated that the sub slab soil gas has been reduced below applicable screening values and/or groundwater concentrations are below GW-2. If at any point, evaluation of long-term monitoring data indicated significant negative changes in Site conditions, then contingent remedial alternatives would be evaluated and implemented to supplement or replace the existing systems.

Alternative OU2-1

The major components of Alternative OU2-1 are:

- Monitored natural attenuation of contaminants in groundwater and soil vapor;
- Placing an AUL on the impacted portions of the property restricting changes to existing and foreseeable future use;
- Performing groundwater, soil gas and indoor air quality monitoring and documenting the alternative effectiveness.

The extent of Alternative OU2-1 is shown on Figure 4.3.2-1. An AUL would be filed and would require continued monitoring and documentation of groundwater, soil gas and indoor air quality, limitations that prohibit disruption of the building floor slab and residential use of the property, and mandate use of a

Soil Management Plan and Health and Safety Plan to mitigate potential direct contact with impacted soils that remain on-site.

A Permanent Solution Statement would be filed since current conditions and site uses combined with an AUL provide a condition of No Significant Risk.

Alternative OU2-2

The major components of Alternative OU2-2 are:

- Monitored natural attenuation of contaminants in groundwater and soil vapor;
- Installing a vapor barrier over the floor slab;
- Placing an AUL on the impacted portions of the property restricting foreseeable future use;
- Performing soil gas, groundwater and indoor air quality monitoring and documenting the alternative effectiveness.

The extent of Alternative OU2-2 is shown on Figure 4.3.2-2.

This alternative is similar to OU2-1 in that it allows for natural degradation of contaminants and additionally includes the installation of a vapor barrier as a passive mitigation measure. The vapor barrier would be installed over the existing floor slab including floor penetrations to restrict potential future vapor infiltration.

An AUL would be filed and would require continued monitoring and documentation of soil gas, groundwater and indoor air quality, limitations that prohibit residential use of the property, and mandate use of a Soil Management Plan and Health and Safety Plan to mitigate potential direct contact with impacted soils that remain on-site.

A Permanent Solution Statement would be filed since current conditions and site uses provide a condition of No Significant Risk.

Alternative OU2-3

The major components of Alternative OU2-3 are:

- Monitored natural attenuation of contaminants in groundwater and soil vapor;
- Installing a subslab depressurization system as an Active Exposure Pathway Mitigation Measure (AEPMM);
- Placing an AUL on the impacted portions of the property restricting foreseeable future use;
- Performing ongoing monitoring of the SSDS and documenting the alternative effectiveness.

The extent of Alternative OU2-3 is shown on Figure 4.3.2-3.

This alternative is similar to OU2-1 in that it allows for natural degradation of contaminants and additionally includes the installation of a subslab depressurization system as an AEPMM. The subslab depressurization system would include sealing floor penetrations and installing a series of vacuum wells at strategic locations within the footprint shown on Figure 4.3.2-3. Blowers attached to the vacuum wells, designed to depressurize the vadose zone below the building slab relative to the building space, would prevent the infiltration of vapors into the building space. The off-gas would be treated as required (e.g., with granular activated carbon filters) and vented outside of the building space.

An AUL would be filed and would require continued operation and maintenance of the subslab depressurization system including monitoring in-line manometers to assure adequate vacuum is provided and monitoring emissions for compliance with 310 CMR 40.0049(5). Procedures for subslab depressurization system monitoring and maintenance would be outlined in an Operations, Maintenance and Monitoring Plan (OMMP) for OU2. Additionally, the AUL would require documentation of the alternative's effectiveness, limitations on future use of the property, and mandate use of a Soil

Management Plan and Health and Safety Plan to mitigate potential direct contact with impacted soils that remain.

A Permanent Solution Statement would be filed since current conditions and site uses combined with an AUL would provide a condition of No Significant Risk.

4.2.3 OU3

OU3 focuses on source control and includes Aerovox property soils (OU3A) and Aerovox property overburden groundwater (OU3B). The remedial action alternatives for these two OUs are presented separately below in the following sections of this report. One objective of the selected remedial action alternative for OU3 is mitigation, to the extent practicable, of contaminant migration from the Site to the Acushnet River, part of the New Bedford Harbor Superfund Site. Because the Acushnet River is also a source of contaminants back into the Aerovox Site, successfully meeting this objective is contingent upon EPA also completing source removal in the river as part of the New Bedford Harbor Superfund Site remediation.

4.3.3.1 OU3A – Aerovox Property Soils

OU3A consists of PCB-contaminated soils at several individual areas on the western and central portions of the Aerovox property and a majority of the eastern portion of the property. Additionally, OU3A includes the existing storm water collection system located on the southern and eastern portion of the Aerovox property which may serve as a preferential migration pathway for contaminants.

The remedial technology retained for the storm water system is independent of the remedial technologies retained to address the PCB-contaminated soils. It is assumed for all alternatives that the storm water system will be cleaned and lined or replaced in-kind depending upon the condition of the system at the time of remediation. Since one remedial technology is assumed to address the storm water system contamination in all of the OU3A remedial action alternatives evaluated, further discussion of the storm water system is not included.

Three remedial action alternatives were developed for OU3A and will be retained for detailed evaluation. The three alternatives are:

- OU3A-1: Excavation and off-site disposal of soils above UCLs and cap areas with PCB concentrations >2 mg/kg;
- OU3A-2: Excavation and ex-situ treatment of soils above UCLs and cap areas with PCB concentrations >2 mg/kg; and
- OU3A-3: Asphalt cap over soils with PCB concentrations >2 mg/kg and construct engineered barriers over soils with PCB concentrations above UCLs.

The alternatives for OU3A are summarized on Table 4.3.3. A description of each potential remedial action alternative is presented below.

In order to perform the excavations for Alternatives OU3A-1 and OU3A-2, the remedial contractor would be required to obtain a Trench Permit from the City of New Bedford taking the following factors into consideration:

- OSHA regulations require benching, sloping, or other excavation support to safely excavate to depths of five feet bgs or greater;
- Groundwater in the vicinity of the excavation areas is tidal and will be encountered for deeper parts of the excavations.

Based on groundwater monitoring activities presented in the Phase II Comprehensive Site Assessment dated September 18, 2015, groundwater will be encountered in excavations deeper than approximately 3 feet associated with Alternatives OU3A-1 and OU3A-2. For cost estimating purposes, groundwater control is assumed to be accomplished by a combination of perimeter dewatering well points and interlocking steel sheet piling. The water associated with the dewatering activities would likely be pre-treated on-site and discharged to the New Bedford POTW.

Following the remedial construction of any alternative, a Final Inspection Report would be completed to document the soil excavation, disposal or ex situ treatment, and cap installation. Additionally, a Permanent Solution Statement would be filed following remedial construction.

An AUL would be filed following the remedial construction of each of the alternatives. The AUL would require continued monitoring, maintenance and documentation of the cap and repairs as necessary, limitations that prohibit residential use of the property, and mandate the use of a Soil Management Plan and Health and Safety Plan to mitigate potential direct contact with impacted soils that remain on-site.

Alternative OU3A-1

The major components of Alternative OU3A-1 are:

- Removing asphalt pavement cap, clean soil backfill within building footprint and former building slab to access UCL soils;
- Excavating soils which have PCB concentrations greater than the UCL of 100 mg/kg;
- Transporting and disposing of PCB-impacted soils at an approved off-site facility;
- Onsite consolidation of removed asphalt pavement, clean soil backfill and former building concrete slab;
- Installing a demarcation layer;
- Backfilling excavation areas with site soil or imported clean backfill;
- Restoring the ground surface in kind (i.e., asphalt pavement);
- Placing an AUL on the impacted portions of the property restricting foreseeable future use;
- Performing ongoing monitoring, maintenance and documentation of the soil cap integrity and repairs (as necessary).

This alternative includes excavation of approximately 26,000 cubic yards of PCB-impacted soils to depths of between three feet and fifteen feet bgs. This volume and the associated cost estimate assumes all excavated soils are impacted with PCBs greater than 100 mg/kg. The approximate horizontal limits and depths of this alternative's excavation areas are presented on Figure 4.3.3A-1.

The assumption noted above regarding soil volume notwithstanding, during implementation excavated soils would be segregated based on concentrations. Soils with PCB concentrations below the UCL would be placed as backfill in the excavation areas. Soils with PCB concentrations above the UCL would be transported to and disposed of at an approved off-site disposal facility. For cost estimating purposes, it is assumed that all excavated soil will be transported to and disposed of at an approved off-site facility.

The asphalt cap would be restored at locations where excavation activities do not remove soils with PCB concentrations above the unrestricted reuse criteria. The cap would be designed to provide separation and prevent exposure of site workers and visitors to the remaining impacted soils.

This alternative would require annual monitoring and documentation of the asphalt pavement cap, and repairs as necessary. This alternative does not require operation of treatment technology or any other equipment.

Alternative OU3A-2

The major components of Alternative OU3A-2 are:

- Excavation of soils which have PCB concentrations greater than the UCL of 100 mg/kg;
- Ex-situ treatment of excavated soils on-site to reduce PCB concentrations to below the UCL;

- Installing a demarcation layer;
- Backfilling excavation areas with site soil or imported clean backfill;
- Restoring the ground surface in kind (i.e., asphalt pavement);
- Placing an AUL on the impacted portions of the property restricting foreseeable future use;
- Performing ongoing monitoring, maintenance and documentation of the soil cap integrity and repairs (as necessary).

This alternative includes excavation of approximately 26,000 cubic yards of PCB-impacted soils to depths of between three feet and fifteen feet bgs. As noted above, this volume does not include segregation of excavated soils with PCBs greater than 100 mg/kg. The approximate horizontal limits and depths of this alternative's excavation areas are presented on Figure 4.3.3A-2.

Excavated soils would be segregated based on concentrations. Soils with PCB concentrations below the UCL would be placed as backfill in the excavation areas. Soils with PCB concentrations above the UCL would be treated by either biological, chemical, or thermal means. Treatment would reduce PCB concentrations to below the UCL. Treated soils would be placed as backfill in the excavation areas. The treatment method would be selected based on bench testing or a pilot study performed during the Phase IV design.

The asphalt cap would be restored at locations where excavation activities do not remove soils with PCB concentrations above the unrestricted reuse criteria. The cap would be designed to provide separation and prevent exposure of site workers and visitors to the remaining impacted soils.

This alternative would require annual monitoring and documentation of the asphalt pavement cap, and repairs as necessary. This alternative does not require operation of treatment technology or any other equipment.

Alternative OU3A-3

The major components of Alternative OU3A-3 are:

- Installing a demarcation layer;
- Constructing an engineered barrier over soils with PCB concentrations greater than 100 mg/kg;
- Constructing a pavement cap over soils with PCB concentrations greater than 1 mg/kg;
- Placing an AUL on the impacted portions of the property restricting foreseeable future use;
- Performing ongoing monitoring, maintenance and documentation of the engineered barrier; and pavement cap integrity and repairs (as necessary).

This alternative includes containment of PCB-impacted soils by either an engineered barrier or a pavement cap. The existing asphalt cap is suitable for soil with PCB concentrations below the UCL. An engineered barrier would be installed in areas where PCB concentrations are above the UCL. The approximate horizontal limits of the engineered barrier are presented on Figure 4.3.3A-3.

This alternative would require annual monitoring and documentation of the asphalt pavement cap and engineered barrier, and repairs as necessary. A financial assurance mechanism will be required for engineered barrier maintenance. This alternative does not require operation of treatment technology or any other equipment.

4.3.3.2 OU3B – Aerovox Property Overburden Groundwater

Operable unit OU3B consists of CVOC and/or PCB contaminated overburden groundwater at the site. The following four remedial action alternatives were developed for OU3B and will be retained for detailed evaluation.

- Alternative OU3B-1 – Containment Via Vertical Barrier Wall

- Alternative OU3B-2 – Containment via Vertical Barrier Wall and Hydraulic Containment
- Alternative OU3B-3 - Containment via Vertical Barrier Wall and Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater
- Alternative OU3B-4 – Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater

To facilitate the evaluation of the potential remedial groundwater action alternatives at the site, a three dimensional groundwater flow model was developed using the Modular Three-dimensional Finite Difference Groundwater Flow Model (MODFLOW). The model was developed to simulate groundwater flow conditions in three layers across the Site; artificial fill and peat, glacial outwash and till, and bedrock. After calibrating the model to steady state conditions using existing site data at low tide, the model was converted to a transient operation to account for the changes in flow (both laterally and vertically) that are caused by the significant tidal fluctuations at the site. By using the transient operation, the model was able to evaluate various remedial scenarios under both low tide and high tide conditions. The goal of the model was to evaluate the effectiveness of the different scenarios on preventing the migration of impacted groundwater off-property, and estimating the amount of groundwater that might need to be managed to mitigate the off-property migration. The Groundwater Modeling Report with associated output figures demonstrating model setup, calibration, and simulation results is included as Appendix C. The key findings of the groundwater modeling are also incorporated into the following discussion of overburden groundwater alternatives.

The four alternatives for OU3B are summarized in Table 4.3.3. A description of each potential remedial action alternative is presented below. These descriptions include the results of the groundwater flow modeling for each alternative.

Alternative OU3B-1 - Containment Via Vertical Barrier Wall

Alternative OU3B-1 consists of installing a very low permeability vertical barrier wall that would surround the portion of the overburden groundwater plume which exceeds Method 1 GW-3 standards at the AVX property. The purpose of this alternative would be to prevent the lateral migration of CVOCs and PCBs beyond the containment wall and into the Acushnet River. However, the groundwater flow modeling indicated that groundwater would flow upward from the bedrock into the overburden on the western end of the barrier, and flow downward into the bedrock on the eastern end of the barrier. The net result is that approximately 50% of the groundwater flowing through the overburden aquifer within the vertical barrier would migrate downward into the bedrock, and ultimately flow to the Acushnet River. As a result, this alternative would not prevent impacted overburden groundwater from migrating off Site.

The approximate configuration of the vertical barrier wall is shown on Figure 4.3.3A-1, and covers a distance of approximately 1900 feet. The wall would be constructed to extend from ground surface through the vertical thickness of the overburden deposits to the top of bedrock (approximate depths of 11 to 37 feet below grade which varies based on the depth to bedrock along the footprint of the proposed wall). Based on the estimated depths to bedrock, the alternative would require the construction of approximately 47,900 square feet of vertical barrier. The type of vertical barrier wall would be selected from the following three proven barrier wall technologies: slurry wall, in situ mixed wall, and sealed sheet piling. Slurry walls typically consist of a bentonite trench slurry that is placed within an excavated trench to hold the trench walls open during excavation. After achieving the target excavation depth, a heavier soil-bentonite or cement-bentonite slurry is used to displace the trench slurry and form the final slurry wall. In situ mixed walls are constructed by mixing in-situ soils with a cement/bentonite based binder slurry. The mixing would occur in situ using long arm excavators or augers, depending on the depth of the wall. Sealed sheet piling is driven into the ground to the desired depth. The selection of which type of barrier wall would be determined during remedial design based on consideration of various factors such as cost, reliability, effectiveness, ease of installation, etc.

Depending on which installation method were selected, there may be excess excavated soils which would need to be handled. These soils could either be direct loaded into trucks for disposal at an approved facility, or consolidated with similar soils for subsequent capping on the property. It is anticipated that installation of the vertical barrier wall would take approximately three months.

The portion of the vertical barrier wall constructed in the Riverfront Area (within 25 feet of the Acushnet River) and buffer zone (within 100 feet of the Acushnet River) may require permitting under the Wetlands Protection Act and local ordinances. In addition, work conducted within 25 feet of the river would need to be designed to support the City of New Bedford's planned Riverwalk.

This alternative would include long term groundwater monitoring for CVOCs and PCBs to evaluate the extent to which impacted groundwater flows off-property to adjacent properties or the Acushnet River. The monitoring network is assumed to consist of approximately six monitoring wells. For this alternative, it was assumed that long term monitoring would be required for at least thirty years. It is anticipated that the first year of monitoring would be conducted on a quarterly basis to confirm the effectiveness of the barrier, and that samples would be collected semi-annually thereafter.

Because the alternative would not prevent or sufficiently mitigate the flow of impacted groundwater into and out of bedrock, and relies solely on natural attenuation to reduce contaminant concentrations, it is likely that a Temporary Solution would be filed. As a result, a Periodic Review would be conducted every five years in accordance with 310 CMR 40.1050(4)(b) until a Permanent Solution Statement was submitted.

Alternative OU3B-2 - Containment via Vertical Barrier Wall and Hydraulic Containment

Alternative OU3B-2 consists of installing a very low permeability vertical barrier wall that would surround the overburden groundwater plume which exceeds GW-3 standards, identical to that described in alternative OU3B-1. The purpose of the vertical barrier would be to prevent the lateral migration of CVOCs and PCBs beyond the containment wall. In order to prevent the downward migration of impacted groundwater into the bedrock, hydraulic containment via groundwater pumping and treatment would be implemented to maintain an inward hydraulic gradient within the vertical barrier (both laterally and vertically). An added benefit of the pumping and treatment would be the removal of contaminant mass and a reduction in groundwater concentrations in the overburden groundwater. As a result, it is anticipated that Alternative OU3B-2 would ultimately achieve a Permanent Solution.

The configuration, installation and monitoring of the vertical barrier component of the alternative would be the same as described above for Alternative OU3B-1. Hydraulic containment would be accomplished by the pumping of groundwater from five overburden extraction wells as shown in Figure 4.3.3B-2, at a combined rate of approximately 65 gallons per minute (gpm). The groundwater would be pumped from the five extraction wells to an on Site building for above ground treatment. Based on the Site contaminants in overburden groundwater (residual NAPL, CVOCs and PCBs), the major components of the groundwater treatment system would include an oil water separator, equalization tanks, solids holding tank, bag filters, an air stripper, and liquid phase and vapor phase activated carbon. The treated groundwater would be discharged either to the local publically owned treatment works (POTW) or a storm drain flowing to the Acushnet River under a NPDES permit. It is anticipated that installation of the vertical barrier walls, extraction wells, and above ground treatment system would take approximately five months.

The portion of the vertical barrier wall and extraction wells constructed in the Riverfront Area (within 25 feet of the Acushnet River) and buffer zone (within 100 feet of the Acushnet River) may require permitting under the Wetlands Protection Act and local ordinances. In addition, work conducted within 25 feet of the River would need to be designed to support the City of New Bedford's planned Riverwalk.

This alternative would also require a NPDES permit to discharge treated groundwater to the Acushnet River, or approval to discharge to the local POTW.

For the purposes of this evaluation, it was assumed that long term operation, maintenance, and monitoring of the groundwater treatment system would continue for a period of twenty years, until concentrations within the containment barrier achieve Method 1 GW-3 standards.

This alternative would include long term groundwater monitoring (estimated at twenty years) for CVOCs and PCBs to assure that impacted groundwater does not flow off-property to adjacent properties or the Acushnet River. The monitoring network is assumed to consist of approximately six monitoring wells. It is anticipated that the first year of monitoring would be conducted on a quarterly basis to confirm the effectiveness of the barrier, the last two years on a quarterly basis to provide the data needed for the Permanent Solution Statement, and that during intervening years the samples would be collected semi-annually. In addition, this alternative would include treatment system influent and effluent monitoring to document that local POTW requirements, or NPDES permit requirements, were met.

A Permanent Solution Statement would be filed upon completion of the groundwater treatment.

Alternative OU3B-3 - Containment via Vertical Barrier Wall and Hydraulic Containment and In Situ Treatment of Soils Acting as a Source to Groundwater

Alternative OU3B-3 consists of installing a very low permeability vertical barrier wall that would surround the overburden groundwater plume which exceeds GW-3 standards, and hydraulic containment via groundwater pumping and treatment. Both of these components would be identical to that described in alternatives OU3B-1 and B-2. The purpose of the vertical barrier would be to prevent the lateral migration of CVOCs and PCBs beyond the containment wall and the purpose of hydraulic containment via groundwater pumping and treatment would be to prevent the migration of impacted groundwater beyond the limits of the vertical barrier (both laterally and vertically). This alternative also includes in situ treatment of soils containing elevated concentrations of CVOCs and PCBs that are acting as a source of contamination to overburden groundwater.

The configuration, installation and monitoring of the vertical barrier component of the alternative would be the same as described above for Alternative OU3 B-1. The number of extraction wells, extraction rate, treatment system components, discharge of treated groundwater and treatment system monitoring would be the same as described above in Alternative OU3B-2.

The in situ treatment of soils acting as a source to groundwater would be conducted to shorten the timeframe needed to achieve a Permanent Solution relative to Alternative OU3B-2. This component of the alternative would consist of direct push injection of a slurry (approximately 395,000 lbs of the amendment for the first injection round) consisting of zero-valent iron (ZVI), organic carbon, and microorganisms (Dehalococcoides sp., DHC) into the saturated thickness of the overburden aquifer at approximately 408 injection points within the area shown on Figure 4.3.3B-3. ZVI will promote abiotic dechlorination while the organic carbon will promote biotic dechlorination; bioaugmentation with DHC culture will enhance the dechlorination rates and promote complete dechlorination of TCE to ethene. It is anticipated that this alternative would include two rounds of slurry injections of the reagents noted above. The installation of the vertical barrier wall, extraction wells, above ground treatment system, and in situ treatment system is anticipated to take approximately six months.

The portion of the vertical barrier wall, extraction wells, and injection points installed in the Riverfront Area (within 25 feet of the Acushnet River) and buffer zone (within 100 feet of the Acushnet River) may require permitting under the Wetlands Protection Act and local ordinances. In addition, work conducted within 25 feet of the River would need to be designed to support the City of New Bedford's planned Riverwalk. This alternative would also require a NPDES permit to discharge to treated groundwater to the Acushnet River, or approval to discharge to the local POTW. This alternative would also require MassDEP approval for the addition of Remedial Additives with 50 feet of the Acushnet River.

For the purposes of this evaluation, it was assumed that long term operation, maintenance, and monitoring of the groundwater treatment system would continue for a period of ten years, until concentrations within the containment barrier achieve GW-3 standards.

This alternative would include long term groundwater monitoring (estimated at ten years) for CVOCs and PCBs to assure that impacted groundwater does not flow off-property to adjacent properties or the Acushnet River. The monitoring network is assumed to consist of approximately six monitoring wells. It is anticipated that the first year of monitoring would be conducted on a quarterly basis to confirm the effectiveness of the barrier, the last two years on a quarterly basis to provide the data needed for the Permanent Solution Statement, and that during intervening years the samples would be collected semi-annually. In addition, this alternative would include treatment system influent and effluent monitoring to document that local POTW requirements, or NPDES permit requirements, were met. The alternative would also include monitoring of representative monitoring wells within the containment area to evaluate the effectiveness of the in situ treatment of soils.

This alternative would include the filing of an AUL to prevent contact with residual contamination within the vertical barrier. A Permanent Solution Statement would be filed upon completion of the soil and groundwater treatment.

Alternative OU3B-4 – Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater

Alternative OU3B-4 consists of installing a permeable reactive barrier (PRB) along the downgradient side of the property to treat CVOCs and PCBs in the overburden deposits prior to their discharge to the Acushnet River. Very low permeability vertical barrier walls would be installed on the northern and southern sides of the property to prevent the lateral migration of impacted groundwater off-property. In order to prevent the downward migration of impacted groundwater into the bedrock, the PRB would be designed and constructed with a hydraulic conductivity very similar to the overburden deposits so that overburden groundwater would flow through the barrier as opposed to flowing downward in the bedrock. The groundwater model indicates that approximately 99% of the overburden groundwater in the contained area will be treated by the PRB. Because impacted groundwater would be prevented from flowing to the Acushnet River, and hot spots areas would be addressed with in situ treatment, this Alternative would be consistent with the MCP RAPS preference for alternatives that favor treatment over containment (310 CMR 40.0191(3)) and would achieve a Permanent Solution.

The configuration and installation of the very low permeability barrier walls component of the alternative would be the same as described above for Alternative OU3B-1. As with the low permeability barrier walls, the PRB would be constructed to extend from ground surface through the vertical thickness of the overburden deposits to the top of bedrock. The approximate configuration of the low permeability barrier walls and PRB are presented on Figure 4.3.3B-4. The low permeability barrier walls would cover a distance of approximately 960 feet, and the PRB would cover a distance of approximately 520 feet. Based on the estimated depths to bedrock, this alternative would require the construction of approximately 24,100 square feet of low permeability barrier walls and approximately 16,600 square feet of PRB. It is anticipated that installation of the low permeability barrier walls, PRB, and in-situ treatment of soil hot spots would take approximately four months.

The PRB media would primarily consist of ZVI, carbon, and sand. ZVI is proven to degrade chlorinated solvents such as TCE while carbon is known to absorb VOCs (including TCE) and PCBs. Most of the COC mass in the groundwater is expected to be TCE and therefore the primary function of the PRB media will be degradation by ZVI with carbon serving as a backup for adsorption for residual TCE, other VOCs, and PCBs. Sand is included in the media to provide adequate hydraulic conductivity so that the groundwater flow within the PRB is similar to the flow outside the PRB. Thus, a PRB technology with combined ZVI-Carbon media along with sand is expected to address the Site COCs (TCE and PCBs).

The in situ treatment of soils acting as a source to groundwater would be conducted to shorten the timeframe needed to achieve a Permanent Solution, to avoid the need to replenish the PRB media. The in situ treatment would be targeted to treat about 30 percent of the total area identified under Alternative OU3B-3. This 30 percent area would represent the hot spots close to northern portion of the proposed PRB in the vicinity of MW-15B and MW-7 as shown in Figure 4.3.3B-4. This component of the alternative would consist of direct push injection of a slurry (approximately 120,000 lbs of the amendment for the first injection round) consisting of ZVI, organic carbon, and microorganisms (DHC culture) into the saturated thickness of the overburden aquifer at approximately 15-foot to 30-foot centers within the in-situ treatment area shown on Figure 4.3.3B-4. The function and role of ZVI, organic carbon, and DHC culture would be the same as that described for Alternative OU3B-3. It is anticipated that this alternative would include two rounds of slurry injections of the reagents noted above.

The portion of the PRB, very low permeability barrier walls, and in situ treatment of hot spots installed in the Riverfront Area (within 25 feet of the Acushnet River) and buffer zone (within 100 feet of the Acushnet River) may require permitting under the Wetlands Protection Act and local ordinances. In addition, work conducted within 25 feet of the River would need to be designed to support the City of New Bedford's planned Riverwalk. This alternative would also require MassDEP approval for the addition of Remedial Additives with 50 feet of the Acushnet River.

This alternative would include long term groundwater monitoring (estimated at ten years) for CVOCs and PCBs to confirm the mitigation of mass flux from the property to the Acushnet River. The monitoring network is assumed to consist of approximately six monitoring wells. It is anticipated that the first year of monitoring would be conducted on a quarterly basis to confirm the effectiveness of the PRB, the last two years on a quarterly basis to provide the data needed for the Permanent Solution Statement, and that during intervening years the samples would be collected semi-annually.

A Permanent Solution Statement would be filed when it is demonstrated the mass flux in overburden groundwater to the Acushnet River has been mitigated and the plume is stable or shrinking.

4.2.4 OU4

The following two remedial action alternatives were formulated and retained for detailed evaluation for OU4 (bedrock groundwater):

- Alternative 1 – In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation
- Alternative 2 – In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots, and Monitored Natural Attenuation

The two alternatives for OU4 are summarized in Table 4.3.4. A description of each potential remedial action alternative is presented below.

Alternative OU4-1 – In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation

Alternative OU4-1 consists of In-Situ Chemical Oxidation (ISCO) of several hot spots that have been identified in bedrock groundwater. These hot spots include TCE and PCBs in the shallow bedrock (30 to 46 feet below grade) in the vicinity of MW-15B, TCE in the deep bedrock (53 to 198 feet below grade) in the vicinity of MW-34B, and TCE in the shallow to deep bedrock (48 to 89 feet below grade) in the vicinity of MW-26B (Figure 4.3.4-1). These locations are presented on Figure 4.3.4-1.

The goal of the ISCO treatment in these areas would be to reduce groundwater concentrations in the bedrock groundwater to below Upper Concentration Limits (less than 50,000 ug/l for TCE and less than 10 ug/l for PCBs) to eliminate Significant Risk of harm to public welfare and the environment. Following

ISCO treatment, Monitored Natural Attenuation (MNA) would be applied to the bedrock plume. The goal of MNA would be to demonstrate a stable or shrinking groundwater plume.

ISCO is a remedial process where strong chemical agents (oxidants) are introduced into the subsurface to react with and chemically break down the contaminants of concern. The oxidizing agents most commonly used for the treatment of hazardous contaminants in saturated groundwater are hydrogen peroxide, catalyzed hydrogen peroxide, potassium permanganate, sodium permanganate, sodium persulfate, and ozone.

The ISCO reagent selected for the areas around MW-26B and MW-34B would be sodium permanganate, while for the area around MW-15B, the oxidant would be sodium persulfate. Note that groundwater near MW-26B and MW-34B is impacted primarily with TCE, and sodium permanagate oxidant is well suited to destroy TCE; However, at MW-15B the groundwater is impacted with TCE and PCBs and alkaline persulfate-based oxidant is a better choice to destroy these COCs. The alkaline persulfate injections in the vicinity of MW-15B will be via direct push points and not through recirculation as the treatment depth is relatively shallow (30 to 46 feet below ground surface) and recirculation of a high pH alkaline persulfate is not practical. For the remaining two hot spots (vicinity of MW-26B and MW-34B), the conceptual approach would be to recirculate the permanganate solution throughout the target treatment zone. This would be accomplished by injecting the permanganate solution into two injections wells located on the upgradient side of the treatment area, and extracting groundwater/oxidant from one downgradient extraction well for reinjection back into the injection wells. Each of the injection and extraction wells would be screened across the entire depth of the proposed treatment zone for each target area. Permanganate is the oxidant that would be used for injection because it is a more persistent oxidant that would be more effective in a recirculation approach. It is anticipated that two rounds of ISCO injections would be conducted at each of the proposed treatment areas with an injection frequency of approximately once a year.

The portion of the bedrock remedy implemented in the Riverfront Area (within 25 feet of the Acushnet River) and buffer zone (within 100 feet of the Acushnet River) may require permitting under the Wetlands Protection Act and local ordinances. In addition, work conducted within 25 feet of the river would need to be designed to support the City of New Bedford's planned Riverwalk. This alternative would also require MassDEP approval for the addition of Remedial Additives with 50 feet of the Acushnet River.

This alternative would include annual groundwater monitoring from approximately twelve bedrock monitoring wells for CVOCs and PCBs to demonstrate that groundwater concentrations were reduced to below UCLs. A groundwater monitoring program for MNA would also be implemented following treatment to monitor the effectiveness of treatment and to demonstrate a stable or shrinking bedrock groundwater plume across the Site.

As per the MNA technical guidance documents published by several Agencies, a minimum of eight groundwater sampling events will be performed to determine if MNA is occurring; of the eight, four consecutive quarterly groundwater sampling events will be performed to evaluate the seasonal variations, if any. Sampling will be performed at quarterly intervals for the COCs and geochemical parameters and semi-annually or annually for the microbial parameters and Compound Specific Isotope Analysis (CSIA), if necessary. The analytical data from these sampling parameters will be evaluated for the occurrence of MNA at the site based on the following three lines of evidence: i) Historical groundwater contaminant data that demonstrate a clear and meaningful stable or decreasing trend; ii) Geochemical data that demonstrate indirectly the type(s) of natural attenuation processes active at the Site; and iii) Microbiological evidence including CSIA that supports biodegradation. A combination of three lines of evidence will provide insight regarding whether MNA is occurring at the site.

The Permanent Solution Statement that would be filed for the site would include a demonstration that groundwater concentrations were reduced below UCLs and that the bedrock groundwater plume was stable or shrinking.

Alternative OU4-2 – In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots, and Monitored Natural Attenuation

Alternative OU4-2 consists of In-Situ Thermal Treatment (IST) of the deep bedrock at several hot spots that have been identified in the deeper bedrock. These hot spots include TCE in the deep bedrock (53 to 198 feet below grade) in the vicinity of MW-34B, and TCE in the shallow to deep bedrock (48 to 89 feet below grade) in the vicinity of MW-26B. Because the bedrock groundwater is tidally influenced, it would be extremely difficult to achieve the very high temperatures that are required to thermally break down the PCBs in the shallow bedrock hot spot at MW-15B. Therefore, the hot spot at MW-15B (which contains both TCE and PCBs) would be treated with ISCO (Figure 4.3.4-2). The goal of the ISCO treatment in the deeper bedrock and thermal treatment in the shallow bedrock would be to reduce groundwater concentrations to below UCLs (less than 50,000 ug/l for TCE and less than 10 ug/l for PCBs) to eliminate Significant Risk of harm to public welfare and the environment. These locations are presented on Figure 4.3.4-2.

IST is a process that supplies heat to the fractured bedrock/groundwater through a series of heater borings and steam injection wells that would be drilled to the target depth at each treatment area. As the CVOC-impacted areas are heated, the contaminants would be destroyed or volatilized. Vapors and groundwater would be captured through a series of multiphase extraction wells and pumped to an above ground treatment system. The treatment system would include liquid phase and vapor phase carbon. The treated groundwater would be discharged either to the POTW or a storm drain flowing to the Acushnet River under a NPDES permit. For the purposes of this evaluation, it was assumed that operation, maintenance, and monitoring of the groundwater treatment system would continue for the duration of the thermal treatment which is anticipated to be approximately two to three years.

The portion of the bedrock remedy implemented in the Riverfront Area (within 25 feet of the Acushnet River) and buffer zone (within 100 feet of the Acushnet River) may require permitting under the Wetlands Protection Act and local ordinances. In addition, work conducted within 25 feet of the River would need to be designed to support the City of New Bedford's planned Riverwalk. This alternative would also require a NPDES permit to discharge to treated groundwater to the Acushnet River, or approval to discharge to the local POTW. MassDEP approval for the addition of Remedial Additives within 50 feet of the Acushnet River would also be required.

For the purposes of this evaluation, it was assumed that operation, maintenance, and monitoring of the groundwater treatment system would continue during the IST for a period of approximately two years. In addition, this alternative would include treatment system influent and effluent monitoring to document that local POTW requirements, or NPDES permit requirements, were met.

This alternative would include annual groundwater monitoring from approximately twelve bedrock monitoring wells for CVOCs and PCBs to demonstrate that groundwater concentrations were reduced to below UCLs. A groundwater monitoring program for MNA would also be implemented following treatment to monitor the effectiveness of the treatment and to demonstrate a stable or shrinking bedrock groundwater plume across the Site. The MNA program would be the same as that described for Alternative OU4-1.

The Permanent Solution Statement that would be filed for the Site would include a demonstration that groundwater concentrations were reduced below UCLs and that the bedrock groundwater plume was stable or shrinking.

4.3 Common Elements of the Remedial Alternatives

Common elements exist between the remedial action alternatives selected for each of the OUs. For the shallow uncapped soils (OU1), the element common to all four alternatives is excavation of soils with consolidation or off-site disposal to reduce direct contact exposure to soils. While each of the four alternatives requires excavation of impacted soils, they vary in the soil PCB concentrations left in place and the overall quantity of excavated soils. Three of the four remedial action alternatives (OU1-1, OU1-2 and OU1-4 would result in placement of an AUL to identify allowable and prohibited uses, as well as maintenance requirements.

The three remedial action alternatives for Precix property vapor intrusion (OU2) each include a long term monitoring or maintenance requirement and placement of an AUL to restrict foreseeable future building uses to those that would result in no greater exposure than under current use. The AULs for two of the three remedial action alternatives (OU2-2 and OU2-3) would also require that the AUL provide for long term maintenance of the implemented vapor intrusion mitigation system.

Each of the three remedial alternatives for source area soils (OU3-A) include capping site soils that contain PCB concentrations greater than 2 mg/kg (> 2mg/kg) in accordance with the TSCA Determination requirements, cleaning and lining or replacement (as needed) of the existing storm sewer infrastructure, and require that the existing AUL included in the Consent Agreements be finalized to restrict current and foreseeable future uses of the property and provide for long-term operation and maintenance of the cap. The four remedial alternatives for source area overburden groundwater (OU3-B) include a vertical barrier wall into bedrock and a long-term groundwater monitoring component to evaluate the effectiveness of the selected containment. Three of the four remedial action alternative options (OU3B-2, OU3B-3 and OU3B-4) incorporate a second technology in conjunction with the vertical barrier wall. These alternatives include hydraulic containment with ex-situ treatment, in-situ treatment, and a permeable reactive barrier along the downgradient (east) end of the impacted area.

The two remedial action alternatives proposed for evaluation for site-wide bedrock groundwater both contain treatment of source area hot spots and monitored natural attenuation.

Section 5

Detailed Evaluation of Alternatives (310 CMR 40.0857)

The purpose of this section is to present the detailed comparative evaluation of the Remedial Action Alternatives of each OU that were identified and developed in Section 4 against the criteria specified in 310 CMR 40.0858. The detailed evaluation provides the basis for selection of an alternative for each OU and includes consideration of each alternative's effectiveness, reliability, difficulty of implementation, cost, risks, benefits, timeliness and non-pecuniary interests.

Tables 5.1 through 5.4 provide a detailed comparative evaluation of the ability of each of the alternatives to meet the detailed evaluation criteria (and the subcategories for each criteria as identified in the MCP). For all criteria, the alternatives are given a qualitative rating such as poor, fair, good, or very good relative to each other. Additionally, for all criteria, the alternatives are given a score of 1 to 4 for poor to very good ratings, respectively. The scores are used to illustrate, when summed, the overall favorability in the selection of the remedial action alternative. All criteria were weighed equally in calculating the overall alternative score.

Conceptual-level cost estimates developed for each of the alternatives are included in Appendix D. The estimates include capital costs related to materials, labor, laboratory analysis, engineering design and reporting, oversight, operations, maintenance, monitoring and documentation, as appropriate. The cost estimates have been developed at a +50/-30 percent level of accuracy, consistent with standard conceptual design/feasibility study level cost estimates. Annual operation, maintenance, and monitoring costs have been considered in the calculation of the present worth of each alternative assuming a discount rate of three percent.[4]

The following discussion is a summary of the evaluation presented in Tables 5.1 through 5.4. As such, the focus of this discussion is to present the key criteria that cause the alternatives to be ranked differently, as opposed to a detailed discussion of each criteria/subcriteria.

The effectiveness of the Remedial Action Alternatives is evaluated in terms of:

- Achieving a Permanent or Temporary Solution
- Reusing, recycling, destroying, detoxifying, or treating oil and hazardous material, and
- Achieving or approaching background concentrations.

The reliability of the Remedial Action Alternatives is evaluated in terms of:

- Certainty of Success; and
- Effectiveness of measures to manage residues or control emissions/discharges.

The implementability of the Remedial Action Alternatives is evaluated in terms of:

- Technical complexity;
- Integration with facility operations;

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[4] The 3% discount rate was selected and consistently applied in the cost estimates as a reasonably conservative value comparable to nominal treasure interest rates as published by the Office of Management and Budget over the past five years for 10-year to 30-year maturities.

- Monitoring, O&M or site access requirements/limitations;
- Availability of services, materials, equipment or specialists;
- Availability, capacity and location of off-site treatment, storage and disposal facilities; and
- Permits.

The cost of the Remedial Action Alternatives is evaluated in terms of:

- Cost of implementation (not including cost of environmental restoration);
- Cost of environmental restoration and potential damages to natural resources; and
- Cost of energy consumption.

The risk of the Remedial Action Alternatives is evaluated in terms of:

- Risk during implementation;
- Risk during operations; and
- Risk associated with remaining oil and hazardous materials.

The benefits of the Remedial Action Alternatives are evaluated in terms of:

- Restores natural resources;
- Achieves productive reuse of the site;
- Avoids cost of relocating people; and
- Avoids lost value of the site.

The timeliness of the Remedial Action Alternatives is evaluated in terms of:

- Time to eliminate uncontrolled sources and achieve a level of No Significant Risk.

The non-pecuniary considerations of the Remedial Action Alternatives are evaluated in terms of:

- Aesthetics; and
- Community acceptance.

The sustainability of the Remedial Action Alternatives is evaluated in terms of the alternative's ability to:

- Eliminate or reduce to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem impacts, though energy efficiency, renewable energy use, materials management, water reduction, land management, and ecosystem protection.

5.1 Remedial Alternatives for Impacted Shallow Uncapped Soils (OU1)

The detailed evaluation of remedial alternatives for OU1 is presented in Table 5.1, and discussed below.

5.1.1 Effectiveness

Although the alternatives will not reuse, recycle, destroy, detoxify, or treat OHM, they will all achieve a Permanent Solution in a reasonable timeframe, either with or without an AUL. OU1-1 and OU1-2 both have a good effectiveness rating since they include the removal of PCB-impacted soils. OU1-3 has a very good effectiveness rating since this alternative will approach background concentrations after removal of PCB-impacted soil at concentrations greater than Unrestricted Use Risk Based Concentrations (1 mg/kg). OU1-4 has a fair effectiveness rating since this alternative leaves PCB-impacted soil at greater than the UCL in the subsurface.

5.1.2 Reliability

OU1-1 and OU1-2 both have a good reliability rating since they will be highly successful due to the removal of PCB-impacted soils. However, their effectiveness is dependent on AUL compliance. OU1-3 has a very good reliability rating since this alternative includes the removal of PCB-impacted soil at concentrations greater than Unrestricted Use Risk Based Concentrations (1 mg/kg) and further management of residuals via an AUL is not required. OU1-4 has a good reliability rating since it will provide containment of PCB-impacted soil. However, the effectiveness of this alternative is dependent on AUL compliance.

5.1.3 Implementability

Current site operations do not regularly use this portion of the Titleist property. Therefore, all of the alternatives will have minimal effect on facility operations. However, OU1-4 would diminish the use of the remedial cap area. OU1-1, OU1-2 and OU1-4 would entail minor site restrictions due to the need to implement a site AUL. Services, materials, equipment or specialists, and off-site disposal facilities for impacted soil are readily available for all alternatives. A Wetlands Protection Act permit would be required for each alternative; however, OU1-1, OU1-2 and OU1-3 would also require a trenching permit for excavation.

Due to the similarities for these criteria outlined above, the implementability of the OU1 alternatives is driven by the technical complexity. OU1-1 has a very good implementability rating since this alternative would require low to moderate technical complexity associated with removal of PCB-impacted soil along the river. OU1-2 and OU1-3 have a good implementability rating since these involve moderate to high technical complexity associated with removal of PCB-impacted soil below the water table and adjacent to the building requiring excavation support. OU1-4 has a very good implementability rating due to low technical complexity associated with construction of the engineered barrier.

5.1.4 Cost

Due to current site conditions and uses, there is no cost associated with these alternatives associated with environmental restoration or potential damage to natural resources. Estimated capital costs and Total Net Worth (TNW) for each alternative are summarized in the following table:

Estimated Capital Costs and TNW for Each Alternative		
Remedial Alternative	Estimated Capital Cost	Estimated Total Net Worth (30 years)
OU1-1	$4.2 million	$4.4 million
OU1-2	$5.3 million	$5.5 million
OU1-3	$6.3 million	$6.3 million
OU1-4	$0.7 million	$0.9 million

OU1-1 has a very good cost rating since it has a relatively moderate implementation cost and does not require a financial assurance mechanism. Due to relatively high implementation and energy costs, OU1-2 has a fair cost rating and OU1-3 has a poor cost rating. OU1-4 has a good cost rating due to a low implementation cost but requires a financial assurance mechanism.

5.1.5 Risk

OU1-1, OU1-2, and OU1-3 each involve a moderate level of risk to construction workers during remedy implementation associated with heavy equipment and excavation of impacted soil, and pose a low potential risk to the public if excavated soils are transported offsite. OU1-1, OU1-2, and OU1-4 each pose a low potential risk to future site workers following remedy implementation since soils will remain in the subsurface which have PCB concentrations greater than unrestricted use risk based concentrations. Each of the alternatives achieves a level of No Significant Risk following remedy implementation.

Due to the similarities between the alternatives related to risk, OU1-1, OU1-2, and OU1-4 have a good risk rating. OU1-3 has a very good risk rating since it poses no risk to future site workers, the public, or future residents due to the removal of soils which have PCB concentrations greater than unrestricted use risk based concentrations.

5.1.6 Benefits

Considering the current site use and conditions, OU1 does not prevent or limit the availability of natural resources and presently allows for productive use of the site. Additionally, none of the alternatives include relocation of residents or businesses. These criteria are not applicable and not considered in this evaluation as differentiating factors.

OU1-1, OU1-2 and OU1-3 all restore the waterfront area green space and provide greater harmony with the City of New Bedford’s intent regarding development of a riverwalk. OU1-1 and OU1-2 have a good benefit rating since these alternatives allow for continued commercial/industrial use of the site and do not result in lost value. OU1-3 has a very good benefit rating since this alternative allows for continued commercial/industrial use of the site as well as the possibility of residential use (e.g., potential for gained value). OU1-4 has a fair benefit rating since this alternative allows for continued commercial/industrial use of the site, but requires monitoring and maintenance of the remedial cap as well as a financial assurance mechanism (e.g., potential lost value).

5.1.7 Timeliness

All of the alternatives have good timeliness since they will all achieve a level of No Significant Risk in a relatively short period of time.

5.1.8 Non-pecuniary Considerations

OU1-1 and OU1-2 have a good non-pecuniary rating since these alternatives will restore the current landscaping at the site and are not likely raise community concerns due to removal of PCB-impacted soil and restoration of green space. OU1-3 has a very good non-pecuniary rating since this alternative will restore the current landscaping at the site, is not likely raise community concerns due to removal of PCB-impacted soil and restoration of green space, and provides for potential residential development of the site. OU1-4 has a poor non-pecuniary rating since this alternative will replace existing landscaping with pavement and is likely to raise community concerns due to the loss of green space along the water front and leaving PCB-contaminated soil on-site at concentrations greater than the UCL.

5.1.9 Sustainable Remediation

OU1-1, OU1-2 and OU1-3 each maintain a waterfront green front and provide a permeable surface, and include the possibility to consolidate excavated PCB-impacted soils beneath a separate (OU3) remedial cap that would decrease truck traffic and fuel consumption, and therefore result in relatively higher sustainability.

OU1-1 has a very good sustainability rating since, in addition to the items presented above, this alternative has the lowest carbon footprint by utilizing the least amount of diesel fuel and off-site land disposal capacity. OU1-2 and OU1-3 have a good sustainability rating since these alternatives utilizes more diesel fuel and off-site land disposal capacity compared to OU1-1. OU1-4 has a poor sustainability rating since, although this alternative includes the use of recycled material (e.g. recycled asphalt as part of remedial cap), it utilizes relatively more diesel fuel compared to the other alternatives, utilizes asphalt (i.e., supports tar production), and creates an impermeable surface thereby increasing storm water runoff from the site.

5.1.10 Summary

Alternatives OU1-1 and OU1-3 are tied for the highest overall numerical score (30), compared to overall scores of 27 and 24 for Alternatives OU1-2 and OU1-4, respectively.

5.2 Remedial Alternatives for Vapor Intrusion Mitigation (OU2)

The detailed evaluation of remedial alternatives for OU2 is presented in Table 5.2, and discussed below.

5.2.1 Effectiveness

All three of the alternatives can result in a Permanent Solution relative to the vapor intrusion pathway. The alternatives have the potential to reduce groundwater concentrations in combination with the source control remedy for OU3 and natural attenuation, but the alternatives are not likely to approach background concentrations in a reasonable amount of time. Only Alternative OU2-3 has a good effectiveness rating, as a result of treatment of vapors extracted by the active subslab depressurization system, whereas alternatives OU2-1 and OU2-2 do not reuse or detoxify OHM.

5.2.2 Reliability

Alternative OU2-3 has a very good reliability rating as it is effective in controlling migration of vapors into the building and treating vapor emissions. This alternative would also be highly successful at mitigation of soil gas in conjunction with source remediation at other OUs.

5.2.3 Implementability

Alternative OU2-1 has a very good implementability rating compared to Alternatives OU2-2 and OU2-3, due to low technical complexity and only minor interruption of ongoing facility operations. All three Alternatives have the same long term monitoring and/or maintenance requirement, require services, materials, and equipment that are readily available, and no permits are required. Neither alternative OU2-1 nor OU2-2 generated wastes that would require off-site disposal. OU2-2 is in essence not implementable under current site operations as the shutdown of the facility and movement of equipment would severely interfere with plant production.

5.2.4 Cost

Alternative OU2-1 has a good cost rating compared to the other two alternatives. Estimated capital costs and TNW are summarized in the following table:

Alternative OU2-1 Capital Costs and TNW		
Remedial Alternative	Estimated Capital Cost	Estimated Total Net Worth (30 years)
OU2-1	$0.1 million	$0.8 million
OU2-2	$1.1 million	$1.7 million
OU2-3	$0.9 million	$1.3 million

The difference in cost ratings is the high capital cost and net present value of alternative OU2-2 and the increased electrical consumption required for alternative OU2-3. Each of the three alternatives would require long term monitoring and/or maintenance and OU2-3 would require installation and maintenance of and response to a remote telemetry system.

5.2.5 Risk

Alternatives OU2-2 and OU2-3 have good risk ratings as a result of their acceptable risk for future use provided the effectiveness of the barrier and subslab depressurization systems, respectively, are maintained. Alternative OU2-1 has a fair risk rating because although it has low short term risk during implementation and monitoring activities, it does not provide acceptable risk for future site uses or changed conditions. All three alternatives require an AUL to achieve a condition of No Significant Risk. OU2-1 and OU2-2 require compliance with an AUL that prohibits residential use and OU2-3 requires compliance with an AUL to operate and maintain an AEPMM.

5.2.6 Benefits

Each of the three alternatives would result in continued productive use of the site and would not result in lost value. Alternative OU2-3 provides for site uses other than commercial/industrial provided the subslab depressurization system continues to be maintained and operated as required under the AUL. Alternatives OU2-1 and OU2-3 have a good benefits rating. OU2-2 has a fair benefits rating because maintenance of the vapor barrier would interfere with productive operations in the building.

5.2.7 Timeliness

All three alternatives are dependent upon remedial action alternatives for other site OUs to mitigate contaminated soil and groundwater that are sources of vapor to indoor air. Therefore, the timeliness of all three alternatives is the same; i.e., fair.

5.2.8 Non-Pecuniary Interests

Alternatives OU2-1 and OU2-2 would result in minimal change to the existing building aesthetics due to the presence of permanent subslab monitoring points (four are currently installed) and installation of the vapor barrier over the floor in conjunction with the subslab monitoring points, respectively. Alternative OU2-3 would require moderate changes to the building aesthetics due to the sub slab monitoring points and the equipment and piping associated with an active subslab depressurization system. As a result, the non-pecuniary interests score for alternatives OU2-1 and OU2-2 are good, and for alternative OU2-3 is fair.

5.2.9 Sustainable Remediation

OU2-1 has a sustainable remediation rating of very good, due to use of minimal resources for completion of monitoring events. Alternatives OU2-2 and OU2-3 have good and fair sustainability rankings because both require use of materials and fuel for construction of the remedy, and OU2-3 has higher energy use due to continuous operation of the active SSDS.

5.2.10 Summary

Alternative OU2-1 has the highest overall numerical score of 26, compared to overall scores of 21 and 23 for Alternatives OU2-2 and OU2-3, respectively.

5.3 Remedial Alternatives for Source Area (OU3)

The detailed evaluation of remedial alternatives for source area OU3 (both overburden soil and overburden groundwater) is presented in Table 5.3 and discussed below.

5.3.1 Alternative OU3A - (Overburden Soils)

5.3.1.1 Effectiveness

All three Alternatives (OU3A-1, OU3A-2, and OU3A-3) have a good effectiveness rating because they all have a high likelihood of achieving a Permanent Solution in a reasonable timeframe, although none of the alternatives will achieve or approach background concentrations in soil. Alternatives OU3A-1 and OU3A-3 do not reuse, recycle destroy, detoxify or treat OHM, while Alternative OU3A-2 will detoxify OHM above UCLs.

5.3.1.2 Reliability

All three OU3A alternatives have a good reliability rating because they are likely to be successful and effective in managing OHM provided an AUL is established, a remedial cap is maintained and there is continued compliance with conditions in the AUL.

5.3.1.3 Implementability

The Property is not currently in use and therefore no disturbance of facility operations is anticipated for any of the Alternatives. All three Alternatives would also require monitoring and maintenance of a remedial cap and/or Engineered Barrier. The key differentiating factors between the Alternatives are technical complexity, availability of specialty contractors, and permitting. Alternative OU3A-2 has a fair implementability rating because there would be a high degree of technical complexity to successfully treat soils with concentrations above UCLs, there is a moderately limited pool of specialty contractors experienced in ex-situ treatment of PCB contaminated soils, and it would require EPA approval for the on-site treatment of PCB soils. Alternative OU3A-1 has a good implementability rating because there would be low to moderate technical complexity for soil removal along the River, off -site disposal facilities are readily available, and a moderate level of effort would be required to obtain permits. Alternative OU3A-3 has a very good implementability because of the three alternatives it is the least technically complex to install, does not require off-site disposal, and requires the least level of effort to permit.

5.3.1.4 Cost

Alternatives OU3A-1 and OU3A-2 have poor cost ratings compared to a very good cost rating for Alternative OU3 4-3. The primary differentiating factor was the estimated cost of implementation as summarized below:

OU3A-1 and -2 Estimated Cost of Implementation		
Remedial Alternative	Estimated Capital Cost	Estimated Total Net Worth (30 years)
OU3A-1	$22.7 million	$23.1 million
OU3A-2	$26.3 million	$26.7 million
OU3A-3	$2.5 million	$2.9 million

Due to current site conditions and uses, there would be no cost associated with environmental restoration or potential damage to natural resources for these alternatives. All three alternatives would have either moderate to high, or high, energy consumption during implementation.

5.3.1.5 Risk

The differentiating factor among the three alternatives for risk is the risk during implementation. Alternatives OU3A-1 has a fair risk rating because during construction there would be moderate risk to construction workers associated with the use of heavy equipment during excavation and loading of impacted soil and a potential short term risk to the public during transport of impacted soils through the neighborhood. Alternative OU3A-2 also has a fair risk rating as there is a higher risk to construction workers during implementation because in addition to excavation of impacted soils there would also be ex-situ treatment of soils, however, there would be no off site transport of impacted soils and therefore no risk to the public. Alternative OU3A-3 has a good risk rating because there is only a low risk to construction workers given excavation of a smaller volume of impacted soils. All three alternatives have a similar and low risk to workers during operations since the area will remain a paved lot. The risk posed by remaining OHM for OU3A-3 is incrementally greater than the other two alternatives due to the presence of soil above UCLs. All three alternatives will lead to a condition of No Significant Risk following implementation.

5.3.1.6 Benefits

All three alternatives restore the site to present surface conditions, allow for potential future commercial/industrial uses of the Site and avoid lost value to the Site. Therefore, all three alternatives have a good benefits rating.

5.3.1.7 Timeliness

Alternatives OU3A-1 and OU3A-3 have very good timeliness ratings because they would both achieve a level of No Significant Risk in a relatively short period of time. Alternative OU3A-2 has a fair timeliness rating because achieving a level of No Significant Risk would take a moderate period of time due to ex-situ treatment of soil with PCBs at concentrations above the UCL.

5.3.1.8 Non-Pecuniary

Alternative OU3-3 has a very good non pecuniary rating because it is not likely to raise community concerns. In contrast, Alternative OU3A-1 has a good rating because truck traffic through the neighborhood may raise some community concerns, and Alternative OU3A-2 has a fair rating because the ex-situ treatment of soils at the Site is likely to raise the most community concerns. None of the three alternatives raise aesthetic concerns because all three will restore the area to prior conditions.

5.3.1.9 Sustainable Remediation

Alternative OU3A-1 has a fair sustainability rating due to high diesel equipment use and off-site truck traffic. Alternatives OU3A-2 and OU3A-3 have good sustainability ratings due to diesel equipment use but the lack of truck traffic for off-site disposal of soils.

5.3.1.10 Summary

Alternative OU3A-3 has the highest overall numerical score of 31, compared to overall scores of 24 and 21 for Alternatives OU3A-1 and OU3A-2, respectively.

5.3.2 Alternative OU3B- (Overburden Groundwater)

5.3.2.1 Effectiveness

Alternative OU3B-1 has a poor effectiveness rating because it will not achieve a Permanent Solution due to flow of impacted deep overburden groundwater to the bedrock and ultimately the Acushnet River, and it does not reuse, recycle, destroy, detoxify, or treat OHM. Alternative OU3 B-2 has a good effectiveness rating because it has a moderate likelihood of achieving a Permanent Solution and would treat OHM in the extracted groundwater. Both Alternatives OU3 B-3 and OU3 B-4 have very good effectiveness ratings since they have a moderate to high likelihood of achieving a Permanent Solution, and both will treat source area soil and groundwater.

5.3.2.2 Reliability

Alternative OU3B-1 has a poor reliability rating since it is unlikely to be successful because impacted deep overburden groundwater will migrate downward into the bedrock and ultimately to the Acushnet River. Therefore, this alternative would not effectively control discharges to the River. The three remaining alternatives are all likely to be successful in preventing the flow of dissolved constituents in overburden groundwater to the Acushnet River in concentrations that would pose an unacceptable risk, and therefore also effective in controlling discharges to the River. The primary differences in reliability between these alternatives are that Alternatives OU3B-3 and OU3B-4 would have a shorter timeframe to achieve success than OU3B-2 due to the addition of treatment to address sources of contamination to groundwater. Alternative OU3B-4 would not require any management of emissions or discharges, whereas Alternative OU3B-3 would require treatment of air and groundwater emissions. Based on these criteria, the reliability ratings for these three alternatives are OU3B-2 (fair), Alternative OU3B-3 (good), and Alternative OU3B-4 (very good).

5.3.2.3 Implementability

The key differentiators regarding implementability between the four alternatives were technical complexity, operation and maintenance requirements, availability of services, availability of TSD facilities, and permitting. Alternative OU3B-2 has a fair implementability rating since it has moderate technical complexity associated with treating groundwater above ground and treating soil in situ, requires operation and/or maintenance of both systems, requires a licensed Wastewater Treatment Plant Operator for quarterly inspections of the groundwater treatment system, and requires additional permitting associated with the treatment components. Alternatives OU3B-2 and OU3B-4 both have good implementability ratings. Although Alternative OU3B-2 is not as technically complex as OU3B-4 (moderate complexity associated with treating groundwater compared to moderate to high complexity for installing a PRB that treats both CVOCs and PCBs in a saline environment and moderate technical complexity for treating soil in situ), it requires the use of licensed Wastewater Treatment Plant Operator and more permitting than Alternative OU3B-4. Both alternatives require operation and maintenance of treatment systems, and require off-site disposal at TSD facilities. Alternative OU3B-1 has the best implementability rating (very good) of the four alternatives since it has the least technical complexity (no groundwater treatment or in situ treatment), does not require the operation and maintenance of a treatment system or any specialty services, does not require the use of a TSD facility, and does not require permits associated with treatment.

5.3.2.4 Cost

The key differentiators for cost were the estimated cost of implementation and the relative cost of energy consumption. The estimated costs of implementation for the four alternatives are summarized below:

Estimated Costs of Implementation – All Four Alternatives

Remedial Alternative	Estimated Capital Cost	Estimated Total Net Worth (30 years)
OU3B-1	$2.7 million	$4.6 million
OU3B-2	$5.1 million	$13.9 million
OU3B-3	$6.8 million	$11.8 million
OU3B-4	$5.1 million	$6.2 million

Alternative OU3-B1 has a good cost rating due to the lowest cost of implementation and only moderate energy consumption associated with installation of the vertical containment barrier. Alternative OU3B-4 has a good cost rating because it has the second lowest cost of implementation and also has only moderate energy consumption associated with installation of the vertical containment barrier, PRB and in situ treatment. Alternative OU3B-2 has a fair cost rating based on a combination of higher cost to implement as well as higher energy consumption associated with the installation of the vertical containment barrier and the operation of a groundwater extraction and treatment system. Alternative OU3B-3 has a poor cost rating due to the highest cost to implement and even greater energy consumption than OU3B-2 due to the additional in situ treatment of soil.

5.3.2.5 Risk

Alternative OU3B-1 has a poor risk rating while the other three alternatives have a good risk rating. The main reason that Alternative OU3B-1 is rated poor is that there are potential risks to the environment from impacted groundwater flowing down into bedrock and ultimately to the River, and there is low contaminant mass removal. Each of the four alternatives have some moderate risk to workers during construction associated with the use of heavy equipment, while Alternatives OU3B-2, OU3B-3 and OU3B-4 have moderate risks to workers during operations. Risks attributable to remaining OHM are greater for OU3B-1 and OU3B-2 given that source areas are not actively treated and the alternatives rely on natural attenuation only to reduce concentrations.

5.3.2.6 Benefits

All four alternatives allow for potential future commercial/industrial uses of the site and avoid lost value to the site. Therefore, all four alternatives have a good benefits rating.

5.3.2.7 Timeliness

Alternative OU3B-1 has a poor timeliness rating since it will not eliminate uncontrolled source or achieve a level of No Significant Risk in a reasonable timeframe. The remaining three alternatives will eliminate uncontrolled sources and may achieve a level of No Significant Risk in a reasonable timeframe. However, Alternative OU3B-2 (fair rating), without active source area treatment, will require a longer timeframe to achieve these goals relative to Alternatives OU3B-3 and OU3B-4 which have good ratings.

5.3.2.8 Non-Pecuniary

Alternatives OU3B-2 and OU3B-3 have fair non-pecuniary ratings because truck traffic and discharges of treated groundwater to the River or the local POTW may raise community concerns. Alternatives OU3B-1 and OU3B-4 have good non-pecuniary ratings since they would not have the potential community concern associated with the discharge of treated groundwater.

5.3.2.9 Sustainable Remediation

Alternatives OU3B-2 and OU3B-3 have fair sustainability ratings due to high diesel equipment use and off-site truck traffic, and high energy use for the long term operation of the groundwater extraction and treatment system. Alternatives OU3B-1 and OU3B-4 have good sustainability ratings since they would not have the same high diesel equipment use and off-site truck traffic as the other two alternatives, but there would be no high energy use for the long term operation of a groundwater extraction and treatment system.

5.3.2.10 Summary

Alternative OU3B-4 has the highest overall numerical score of 29, compared to overall scores of 21, 22, and 23 for Alternatives OU3B-1, OU3B-2, and OU3B-3, respectively.

5.4 Remedial Alternatives for Bedrock Groundwater (OU4)

The detailed evaluation of remedial alternatives for OU4 is presented in Table 5.4, and discussed below.

5.4.1 Effectiveness

Both alternatives have a good effectiveness rating because both have a high likelihood of achieving a Permanent Solution in a reasonable timeframe, and both destroy or treat contaminants in the bedrock groundwater. Both alternatives will reduce bedrock groundwater concentrations to below the levels needed to reach a condition of No Significant Risk, but given the nature of contaminant transport and sequestration in bedrock fractures and matrices, achieving or approaching background concentrations in groundwater is technically impracticable.

5.4.2 Reliability

Alternative OU4-2 has a very good reliability rating compared to Alternative OU4-1 which has a good reliability rating because IST has a somewhat higher certainty of success than ISCO. Both alternatives were considered equally effective in managing wastes or controlling emissions or discharges to the environment.

5.4.3 Implementability

Alternative OU4-1 has a good implementability rating compared to a poor implementability rating for Alternative OU4-2. Both alternatives require a high level of technical complexity to implement, however, Alternative OU4-2 has a greater number of technical issues to address because two different in situ technologies would be employed, and this alternative would also require the operation, maintenance and monitoring of a groundwater treatment system. Alternative OU4-2 would also require an upgrade to the existing electrical service at the property to support the energy requirements of the IST, and would require the off-site disposal of liquid and vapor phase carbon from the groundwater treatment system. The permitting associated with Alternative OU4-2 would also be more complicated because in addition to the MassDEP approval that would be required for ISCO applications within 50 feet of the river for both Alternatives, Alternative OU4-2 would also require a Construction General Permit, a Remediation General Permit, and either a NPDES permit to discharge treated effluent from the groundwater treatment system to the River or approval to discharge to the local POTW.

5.4.4 Cost

Alternative OU4-1 has a good cost rating compared to a poor cost rating for Alternative OU4-2. These ratings were based on two differentiating factors: the estimated cost of implementation and the relative cost of energy consumption. The estimated costs of implementation are summarized below:

OU4-1 Estimated Cost of Implementation		
Remedial Alternative	Estimated Capital Cost	Estimated Total Net Worth (30 years)
OU4-1 ISCO of Hot Spots and MNA	$3.1 million	$3.8 million
OU4-2 IST of Deep Bedrock Hot Spots, ISCO of Shallow Bedrock Hot Spots, and MNA	$11.2 million	$11.9 million

In addition to these differences in estimated costs, the IST component of Alternative OU4-2 would require very high energy (electricity) consumption compared to the low energy consumption that would be required for ISCO under Alternative OU4-1.

5.4.5 Risk

Both alternatives have a good rating for the overall risk posed during implementation and operations, and the risk associated with remaining OHM at the site. Both alternatives have only low short-term risks to workers during installation of the injection/extraction wells and groundwater treatment system. The potential risk to workers and the public during implementation were also considered low for both alternatives, with the exception of a moderate risk to workers during the transport and handling of oxidants (both alternatives). Both alternatives would achieve a level of No Significant Risk to human health, safety, public welfare and the environment in the bedrock groundwater once the remedial actions had reduced concentrations below UCLs.

5.4.6 Benefits

Both alternatives allow for future commercial/industrial use of the site, and both avoid lost value to the Site. Therefore, both alternatives have a good benefits rating.

5.4.7 Timeliness

Alternative OU4-1 has a good timeliness rating as it is expected to reduce hot spot concentrations in the bedrock groundwater to below UCLs in approximately three to four years. Alternative OU4-2 would require a similar timeframe for the ISCO treatment in the hot spot at MW-15B, but a shorter timeframe of approximately two years in the remaining hot spots where IST would be applied, and therefore has a very good timeliness rating.

5.4.8 Non-Pecuniary

Both alternatives have good non-pecuniary ratings. There are no aesthetic impacts associated with either alternative, however, both have the potential to raise community concerns during transport of oxidants to the site.

5.4.9 Sustainable Remediation

Alternative OU4-2 has a poor sustainable remediation rating because of the very high electrical usage during implementation of the IST, compared to a good rating for Alternative OU4-1. Both alternatives would have moderate sustainability associated with the use of chemical oxidants.

5.4.10 Summary

The overall numerical score of alternative OU4-1 (27) is higher than Alternative OU4-2 (23).

Section 6

Selected Remedial Action Alternatives

As required by 310 CMR 40.0859, the following considerations and requirements apply to selection of the Remedial Action Alternatives:

- With limited exception, the remedial action alternatives must be selected based on the results of the detailed evaluation criteria.
- A remedial action alternative that results in a Permanent Solution must be selected if identified and found to have a more cost-effective and timely solution than that for the implementation of a Temporary Solution. If a Permanent Solution is not feasible, a Temporary Solution that eliminates substantial hazards must be selected and implemented, and a plan for the identification and development of a Permanent Solution must be prepared.
- A selected Permanent Solution must reduce the concentrations of OHM in the environment to levels that achieve or approach background, to the extent feasible.
- An Engineered Barrier, cap, or other remedial action alternative that relies upon on-site disposal, isolation, or containment of OHM shall not be selected until a Phase III evaluation demonstrates that a feasible alternative does not exist.

Based on the results of the comparative analysis conducted for each of the remedial action alternatives described in Section 5 and summarized in Tables 5.1 through 5.4, the following sections provide the recommended remedial alternatives for the four identified site OUs. While evaluated independently, the selected alternatives for the four OUs are compatible and complimentary and are intended to create a complete Permanent Solution for the RTN.

6.1 Impacted Shallow Uncapped Soils (OU1) – UCL Removal and Soil Capping

Alternatives OU1-1 and OU1-3 both have a numerical ranking score of 30 and consistently receive good or very good ratings on the evaluation criteria. Alternative OU1-1 reduces concentrations in the top two feet of soil to below 1 mg/kg, which is the unrestricted use criterion, and removes PCB concentrations above the UCL in soils below this depth. Placement of a 2-foot clean soil cap over the area in conjunction with implementation of an AUL will meet the remedial goal of achieving a Permanent Solution. Alternative OU1-3 would approach background concentrations after removal of PCB impacted soil at concentrations above the unrestricted use criteria of 1 mg/kg and would not require implementation of an AUL.

However, alternative OU1-3 requires a higher technical complexity and additional engineering solutions over those required for alternative OU1-1, including higher technical complexity because shoring of the building foundation and excavation below the groundwater elevation would be required. A remediation general permit would also be required to discharge treated groundwater from dewatering activities. In addition to the increased implementability issues, these factors also result in an incremental cost difference for implementation of OU1-3 over OU1-1 of approximately 90%. Therefore, alternative OU1-1 is selected as the remedial action alternative for OU1 Impacted Shallow Uncapped Soils.

6.2 Vapor Intrusion Mitigation (OU2) – Monitoring and Natural Attenuation

The numerical scores for the three Alternatives are 25, 21 and 23 for OU2-1, OU2-2 and OU2-3, respectively. Under existing conditions, a Significant Risk to human health or the environment is not present due to the complete vapor intrusion exposure pathway. Two of the three alternatives are expected to result in a Permanent Solution, however the use of a passive vapor barrier (OU2-2) is not considered a Permanent Solution. The alternatives are considered in conjunction with other response actions for the remainder of the Site. The potential to reduce groundwater concentrations in combination with the source control remedy for OU3 and natural attenuation may ultimately reduce groundwater concentrations in the OU2 area, but the alternatives are not likely to approach background concentrations in a reasonable amount of time. Unlike alternatives OU2-2 and OU2-3, alternative OU2-1 does not require maintenance of engineering controls (vapor barrier or SSDS).

Since OU2-2 does not result in a Permanent Solution and is essentially non-implementable without severe impacts to current plant operations, only OU2-1 and OU2-3 were considered. Neither of these alternatives varies appreciably in outcome for continued commercial/industrial use; the primary difference is cost. The total capital cost and NPV of OU2-1 are $800,000 and $500,000 less, respectively than the total capital cost and NPV for OU2-3. Therefore, OU2-1 Monitoring and Natural Attenuation is selected as the remedial action alternative for OU2.

6.3 Source Area (OU3) – Asphalt Cap, Engineered Barrier, Vertical Barrier, In Situ Hot Spot Treatment and PRB

6.3.1 Aerovox Property Overburden Soils

The three remedial action alternatives for source area soils and groundwater are not anticipated to achieve or reduce COCs to background concentrations. Each alternative is equally likely to result in a reduction of risk such that a Permanent Solution is possible in conjunction with a cap and/or engineered barrier and implementation of and AUL. Of the three proposed alternatives for remediation of OU3 soils, alternative OU3A-3 has the highest numerical score (31) as compared to the scores for alternatives OU3A-2 (23) and OU3-3A (21). Evaluation category ratings for OU3A-3 are consistently good or very good, whereas alternatives OU3A-2 and OU3A-3 each have one poor rating and three or more fair ratings.

Alternative OU3A-3 has the highest rating for implementability, risk, timeliness, non-pecuniary interests and cost. These are a result of the low technical difficulty, low level of effort and low to moderate short term risk during implementation and future operations, coupled with a short period of time to achieve a condition of No Significant Risk. Additionally, the capital costs and total NPV for alternatives OU3A-1 and OU3A-2 are an order of magnitude higher than the costs for OU3A-3, i.e. they are estimated to cost $20.2 million and $23.8 million more, respectively. Based on the numerical score and difference in cost, remedial action alternative OU3A-3, Asphalt Cap Over Soils with PCB Concentrations > 2mg/kg and Engineered Barrier Over Soils with Concentrations above UCLs, is selected as the remedial option for source area soils.

6.3.2 Aerovox Property Overburden Groundwater

Remedial Action Alternative OU3B-4, Containment via Vertical Barrier Wall, Hot Spot In Situ Treatment and Permeable Reactive Barrier has the highest numerical score (29) of the four evaluated alternatives due to the high likelihood of achieving a Condition of No Significant Risk and Permanent Solution in conjunction with OU3A. Alternative OU3B-3 has the second highest numerical score (23). The primary differences between alternative OU3B-3 and OU3B-4 are the following: (1) Alternative OU3B-3 has a moderate to high likelihood of achieving a Permanent Solution, whereas OU3B-4 has a high likelihood of achieving a Permanent Solution; (2) While both of these alternatives treat COCs to reduce overall mass and concentrations, alternative OU3B-4 does not require ex-situ infrastructure and management of emissions and discharges associated with ex-situ treatment; (3) The PRB may require periodic replacement, but there is no ongoing operation and maintenance required for the treatment technology; and, (4) the differences between these two alternatives in total capital costs and NPV are $1.7 million and $4.8 million, respectively, as a result of ongoing operation and maintenance requirements for the OU3B-3 ex-situ treatment system. Therefore, remedial action alternative OU3B-4 has been selected as the remedial option for OU3 Overburden Groundwater.

6.4 Bedrock Groundwater (OU4) – Hot Spot In Situ Chemical Oxidation

The two remedial action alternatives for OU4 Bedrock Groundwater, both rely on treatment technologies and monitored natural attenuation to achieve the remedial goals and a condition of No Significant Risk and Permanent Solution for bedrock groundwater. Neither option is anticipated to reduce COCs to or approaching background concentrations due to the complexity and intransient nature of contaminants in fractured bedrock.

The ratings are equal for both alternatives for the effectiveness, risk, benefits, and non-pecuniary interest evaluation categories. However, while all ratings for alternative OU4-1 are rated “good”, three evaluation categories for alternative OU4-2 are rated poor, including those for implementability, sustainability and cost. Based on equal likelihood for positive outcomes for each of the two alternatives, alternative OU4-1 is the selected remedial action alternative. The primary factors for choosing OU4-1 over OU4-2 are the overall numerical score and consistent good risk ratings, and the order of magnitude difference in total capital costs and NPV. The capital cost and NPV for alternative OU4-1 are $3.1 million and $3.8 million, respectively. These values are $8.1 million lower than the capital cost and NPV values for OU4-2.

Section 7

Feasibility Evaluation (310 CMR 40.0860)

Under certain conditions, the MCP (310 CMR 40.0860) requires an evaluation of the feasibility of these five outcomes:

1. Implementing a Permanent Solution;
2. Reducing the concentrations of oil and hazardous material in the environment to levels that achieve or approach Background;
3. Reducing the concentrations of oil and hazardous material in soil at a Disposal Site to levels at or below applicable soil Upper Concentrations Limits;
4. Eliminating, preventing or mitigating Critical Exposure Pathway(s), and
5. Eliminating or controlling each Source of OHM Contamination, controlling migration of OHM, and removing NAPL at a disposal site in support of a Permanent or Temporary Solution pursuant to 310 CMR 40.1003(5) through (7).

The selected remedial action alternatives for all four OUs collectively are anticipated to achieve a Permanent Solution, so evaluating the feasibility of the first item is not required. A Critical Exposure Pathway does not exist at the Site, so the feasibility of outcome number four also does not need to be evaluated. The remaining feasibility evaluations are provided in the following sections.

7.1 Feasibility of Achieving or Approaching Background (310 CMR 40.0860(1)(b))

MassDEP Policy #WSC-04-160, *Conducting Feasibility Evaluations under the MCP* (Feasibility Guidance), provides guidance on a process for evaluating the feasibility of approaching or achieving background which leads to “presumptive certainty” with respect to the conclusions of the feasibility evaluation. The policy includes four situations where it can be considered to be categorically infeasible to reach or approach background. The four situations identified for categorical infeasibility are the following:

- Excavations under Permanent Structures;
- Remedial actions that will substantially interrupt public service or threaten public safety;
- Remediation of Degradable (non-persistent) Contaminants; and,
- Remediation of Persistent Contaminants Located in S-2 and S-3 soils.

If the situation for a given site is other than those identified under categorically infeasible, a site specific feasibility evaluation must be completed. The site specific evaluation considers whether it is technically feasible to achieve or approach background, and whether there is sufficient benefit compared to the additional cost required to expand the remediation beyond that which is needed to reach a condition of No Significant Risk (NSR) in order to reach background. Relative to the benefit-cost analysis, the Feasibility Guidance provides that “it shall be considered feasible to conduct remedial actions to approach background conditions if the additional costs to remediate beyond NSR are equal to or less than 20 percent of the cost to remediate to NSR.”

The majority of the COCs for the site, and in particular those COCs that are the primary contributors to the potential for significant risk, i.e. TCE, VC and PCBs, are included in Table 9-2 of the Feasibility Guidance, and considered Persistent Contaminants. All of the soil within the Site boundaries are S-2 and S-3 soil with the possible exception of the uncapped soil on the Titleist property (OU1), and therefore satisfy the categorically infeasible criterion for Persistent Contaminants in soil.

The MCP defines Background as "those levels of oil and hazardous material that would exist in the absence of the Disposal Site of concern…" The Feasibility Guidance provides the guideposts for determination of whether concentrations of OHM are Approaching Background for soil and groundwater. For soils, background for persistent contaminants in areas classified as S-1 are considered to approach background if

- The concentration of each persistent contaminant is at or below the Method 1 S-1 Standard;
- The concentration of each persistent contaminant in a soil vapor extraction system has been reduced by treatment to the point of diminishing return below No Significant Risk;
- The mass of each persistent contaminant present in S-1 soils is reduced by 50 percent below the mass present at NSR; or
- The exposure point concentration of each persistent contaminant is reduced 50 percent below the exposure point concentration present at No Significant Risk.

7.1.1 OU1

Three of the four remedial action alternatives evaluated would not reduce PCB concentrations to below the PCB background concentration, which is assumed to be <1 mg/kg. The selected remedy, OU1-1 includes removal of concentrations above 1 mg/kg in the top two feet of soil and removal of deeper soils that contain PCB concentrations above the UCL of 100 mg/kg. The alternative that would reduce concentrations to below 1 mg/kg (i.e. approaching background) is alternative OU1-3.

Under the Feasibility Guidance, an incremental cost of conducting the remedial action to or approaching background concentrations is substantial and disproportionate when the additional costs to remediate beyond a condition of No Significant Risk are equal to or greater than 20% more than the cost to remediate to No Significant Risk. The NPV to complete the chosen remedial action alternative (OU1-1) is estimated to be $4.4 million, while the NPV for implementation of the remedy that would achieve background concentrations is $6.3 million. The incremental cost difference between these two is estimated to be $1.9M, which represents 43% of the cost to implement OU1-1.

Additionally, PCBs are considered persistent contaminants by the Feasibility guidance. Therefore, it is considered categorically infeasible to reduce COC concentrations in soils below a depth of 3 feet (i.e., where soils are classified as S-2 or S-3).

7.1.2 OU2

The objective of OU2 is to address the potential vapor intrusion pathway characterized through the weight of evidence approach based on groundwater levels above GW-2 standards in a GW-2 area, subslab soil gas concentrations above commercial/industrial screening values and indoor air concentrations of COCs that are detected but presently do not present a level of significant risk. The vapor intrusion stems from groundwater contamination, one source of which is the soil and groundwater contamination from the former Aerovox facility (OU3). The OU3 COCs are persistent compounds in soil in an S-2 area and it is therefore categorically not feasible to achieve background at OU3. It would therefore follow that it would not be feasible to achieve background at OU2. The combined, complete remedy for the site will include elimination and control of the Aerovox Site related sources as defined in 310 CMR 40.1003(5).

The OU2 remedial goals are based on eliminating or mitigating the pathway and achieving and maintaining a level of No Significant Risk. The program of monitoring included in OU2-1 will provide a sufficient level of certainty that COCs in groundwater and soil gas are stable or decreasing, and will not worsen, and that contaminant levels in indoor air affected by the Disposal Site will remain at a level at or below No Significant Risk and diminish over time. The VI Guidance contemplates “Background” to mean that there is no longer a Vapor Intrusion Pathway of concern, and the reduction of groundwater impacts through implementation of the source area response actions (OU3), combined with an AUL to prohibit residential, school or daycare use of the property and the results of the monitoring/sampling in alternative OU2-1 will support this finding.

7.1.3 OU3

To achieve background concentrations in soil at OU3, removal of nearly all site soils (with the exception of the easternmost portion of the site that is outside of the delineated Disposal Site boundary) would be necessary. Using the average length of the Disposal Site east to west across the center of the Aerovox property, the average depth to bedrock along this line, and the width of the Aerovox Property, the cost to remove soils down to the bedrock surface are more than $153 million. Compared to the cost to bring the site to a condition of No Significant Risk by implementing remedial action alternative OU3A-3 ($2.9 million), the incremental cost to remediate OU3 overburden soil to background concentrations is far greater than 20%, and therefore, infeasible. In addition, soils present with persistent contaminants below a depth of 3 feet are categorically infeasible to remediate to background concentrations, per the Feasibility Guidance.

The remedy for OU3 overburden groundwater will not reduce groundwater concentrations to background, but is anticipated to achieve the Method 1 GW-3 Standards. The estimated time period for this to occur is ten years. While there are other methods (i.e., chemical oxidation treatment) that might reduce COC concentrations to one-half the Method 1 GW-1 GW-3 standards within a similar time period, the costs would be more than 20% higher than costs to implement remedial action alternative OU3B-4. Therefore, reduction to background concentrations is considered infeasible.

7.1.4 OU4

Similar to the remedy for overburden groundwater on the Aerovox Property, the selected remedial action alternative for bedrock (OU4-1) is not anticipated to result in reduction of COCs to concentrations below one-half the Method 1 GW-3 standards. Additionally, the time to reach background would be substantially longer and the cost to reach background would be more than 20% greater than the cost to reach a condition of No Significant Risk, and is therefore infeasible. Furthermore, due to the complexities associated with contaminant transport through fractured bedrock, including fracture interconnectivity, fracture closures or reduce flow through fractures due to secondary mineralization, as well as due to matrix diffusion, it likely is technologically infeasible to achieve or approach background concentrations in bedrock groundwater.

7.2 Feasibility of Reducing Concentrations Below Upper Concentration Limits (310 CMR 40.0860(1)(c))

With the exception of the selected remedial action alternatives for OU3 overburden soils (OU3A-4), the selected remedial alternatives include a reduction in COCs to concentrations below UCLs. The GW-2 concentrations in groundwater that are believed to be the source of subslab CVOCs and migration to indoor air at the Precix facility are not above UCLs, and this feasibility evaluation is not required for OU2.

Similar to the feasibility of reaching background for OU3A, the costs to remediate soil to levels that are below UCLs are “substantial and disproportionate”. Remedial action alternative OU3A-1 includes removal and off-site disposal of soils on the Aerovox Property that are above UCLs. The NPV for alternative OU3A-1 is estimated to be $23.1 million, whereas the NPV to implement the selected remedy, alternative OU3A-3, is $2.9 million. Removal of UCL soil concentrations is nearly 800% of the cost to remediate to a condition of No Significant Risk.

7.3 Feasibility of Eliminating or Controlling Sources of OHM Contamination, Controlling Migration of OHM, and Removing NAPL (310 CMR 40.0860(1)(e))

The selected remedial action alternatives for OU1, OU3 and OU4 are intended to remove and control migration of OHM by removal of sources. The alternative for OU1 will eliminate soils above UCL concentrations and above 2 mg/kg in the top two feet of soil; alternative OU3A is expected to control migration of COCs by minimizing leaching from soils above the groundwater table as well as prevent migration of contaminants that may be adsorbed to soil and dust particles. Source control for overburden groundwater with the highest concentration of COCs is expected to be contained by the barrier wall, treated in situ in the hot spot area, and treated by the PRB prior to discharge to the Acushnet River, both controlling migration and eliminating the overburden groundwater source to the Acushnet River. Additionally, concentrations outside of the barrier wall will be reduced through the processes of natural attenuation, resulting in a stable or decreasing level of COCs from OU3 and mitigation of the migration pathway associated with OU2. Treatment of the bedrock hotspot areas will further advance the mitigation that was initiated under the IRA, and is expected to treat residual DNAPL and reduce bedrock groundwater concentrations to below UCL levels, eliminating the primary bedrock groundwater source. Presently, NAPL removal is primarily being addressed under an ongoing IRA, and residual NAPL that remains at the time the remedial actions are constructed will either be shown to be immobile or will be addressed as part of the construction of selected remedial alternative.

Section 8

Schedule

8.1 Projected Timeframe to Achieve a Permanent Solution

The selected remedial action alternative consists of different components in each of the four operable units. The anticipated timeframes to achieve the remedial goals for the selected alternatives in each operable unit are summarized below:

- OU1-1 Removal of PCB-Impacted Soils in Upper Two Feet (>1 mg/kg) and at Depth (<>100 mg/kg)
  - Remedy implementation is estimated to take approximately three months to complete.
- OU2-1 Monitored Subslab Soil Gas Attenuation
  - The operable unit currently meets a condition of No Significant Risk, and installation of additional subslab and indoor air monitoring points is estimated to take no more than a week or two. Subsequent monitoring would remain in effect for approximately thirty years or until attenuation demonstrates vapor intrusion related restrictions are no longer required.
- OU3A-3 Asphalt Cap Over Soils with PCB Concentrations >2 mg/kg and Engineered Barrier Over Soils with Concentrations Above UCLs
  - Remedy implementation is estimated to take approximately four months to complete.
- OU3B-4 Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In-situ Treatment of Soil Hot Spots Acting as a Source to Groundwater
  - It is anticipated that this alternative would take approximately ten years to achieve the remedial goals.
- OU4-1 In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation
  - It is estimated that achieving remedial goals in the hot spot areas would take approximately three to four years.

A Permanent Solution Statement would be filed after the remedial goals for all four of the operable units have been achieved and AULs are in place. Based on the above projected timeframes, it is anticipated that a Permanent Solution Statement for the site would be filed approximately ten years after implementation of the remedial action alternative. Remedy Operation Status (ROS) would be maintained until that time. The above timeframe to achieve a permanent solution assume that EPA completes the New Bedford Harbor Superfund Site remediation concurrent with the schedule for MCP response actions, thus eliminating the Acushnet River as a source of contamination into the Site.

8.2 Projected Schedule for Implementation of Phase IV Activities

These activities will be conducted under MCP Phase IV Remedy Implementation which includes performance of pre-design studies, the preparation of a Phase IV Remedy Implementation Plan (RIP) to present the design plans and specifications, remedy implementation, documentation of the construction, and final inspection and completion.

The anticipated schedule is presented in Section 8.2.1. The pre-design investigation, including pilot studies, is discussed in Section 8.2.2.

8.2.1 Projected Schedule

The anticipated schedule for Phase IV activities is as follows:

Activity	Projected Schedule
MassDEP Approval of Phase III RAP (assumed)	December 2016
Preparation of Phase IV RIP	January 2017 - October 2017
RIP Submittal	October 2017
Pre-Design Studies and Pilot Studies	January 2017 - August 2017
MassDEP Approval of RIP (assumed)	January 2018
Bid Phase	January - March 2018
Remedy Implementation+	Spring 2018 – Fall 2019
Post-Remedy Implementation Operation and Monitoring‡	2019 – 2029‡

Notes:

+ Remedy Implementation schedule assumes that the remedial action alternatives are implemented over two construction seasons.

‡ Post-Remedy Implementation Monitoring will be conducted under Remedy Operation Status (ROS) which is a subset of Phase V Operation, Maintenance, and/or Monitoring of Comprehensive Response Actions.

Note that the actual construction schedule will be determined by construction sequencing requirements developed during the preparation of the RIP.

8.2.2 Pilot Studies

Pilot scale studies will be conducted: i) to support the design for Alternative OU3B-4 where a PRB is proposed to address groundwater contamination in the overburden and in-situ treatment of soil and groundwater is proposed to treat overburden "hot spots"; and ii) to support the design for Alternative OU4-1 where in-situ chemical oxidation (ISCO) is proposed to treat high concentrations of COCs in groundwater (hot-spots) in deep bedrock.

OU3B-4 (PRB Pilot Study)

The objective of the pilot scale study is to determine the extent of degradation and remediation of the Site COCs by the ZVI-Carbon based PRB technology and collect design parameters data in support of the proposed full scale PRB remedy to address and reduce groundwater contamination to meet GW-3 standards for TCE (<=5,000 ug/L) and PCBs (<=10 ug/L) in the overburden. The degradation of TCE to innocuous end products (ethene and ethane) due to ZVI treatment is widely reported in literature. Carbon, in the form of granular activated carbon, is known to absorb CVOCs (including TCE) and PCBs. Although TCE abiotic dechlorination by ZVI is well known, its effect on PCBs dechlorination is not clear. Thus, a combined ZVI-Carbon media along with sand (to ensure adequate hydraulic conductivity) is expected to address the Site COCs (TCE and PCBs).

The pilot scale PRB will measure approximately 24 inches in thickness, 33 feet in depth (top of bedrock), and 50 feet in length. The pilot scale study is expected to run up to eight months and it is envisioned that the pilot scale PRB will become part of the full scale design after the termination of pilot testing.

The pilot study will be conducted near the northern portion of the proposed full scale PRB in the vicinities of MW-15B and MW-7 where the COC concentration are high compared to the southern portion of the proposed full scale PRB. The pilot scale PRB will be installed perpendicular to groundwater flow direction. The PRB will be constructed using One-Pass Trenching where the One-Pass operation cuts a precise trench and simultaneously backfills the trench with the reactive materials through a custom delivery box that extends to the bottom of the trench. Monitoring wells will be installed to measure the PRB performance – one monitoring well within the PRB, and one well downgradient of the PRB. The existing MW-15B or MW-7 will be considered as the upgradient monitoring well. Select factors that influence PRB performance include groundwater COCs concentrations, reaction with PRB media and degradation half-lives, and residence time in the PRB as determined by groundwater flow and thickness.

The pilot scale study will monitor for the following process and performance monitoring parameters.

- Groundwater elevations and flow in and around the PRB to measure channeling, if any;
- PRB media constituent's ability to remediate TCE and PCBs;
- Reduction in TCE and PCBs concentrations as the groundwater passes through the PRB; and
- Impact and role of groundwater geochemistry on the PRB longevity (calcium and other salts, alkalinity, nitrates, etc.).

The above process and performance monitoring data collected during the pilot testing will be used in the design (for example, media composition and thickness) and construction of the full scale PRB to address groundwater impacts in the overburden.

OU3B-4 (In-Situ Treatment of Hot Spots Pilot Study):

The objective of the pilot scale study is to evaluate the extent of degradation of the Site COCs caused due to in-situ injection of reagents (such as ZVI and organic carbon based electron donor sources) and to collect design parameters data in support of the proposed full scale in-situ injections. The full scale injections remedy will be performed at the overburden areas with high soil COC concentrations (hot spots) to address and reduce groundwater concentrations to meet GW-3 standards for TCE (<=5,000 ug/L) and PCBs (<=10 ug/L). ZVI and proven organic carbon based electron donor sources along with bioaugmentation culture, Dehalococcoides sp., will be considered for injections in the pilot study to promote abiotic and biotic dechlorination.

The location proposed for the in-situ pilot test is the vicinity of MW-7 and covers a small plume area of approximately 75 feet x 50 feet and a depth of approximately 33 feet below ground surface. The 75-foot width will be perpendicular to the groundwater flow and 50-foot length will be parallel to groundwater flow. A biobarrier will be created by one row of five injection points spaced at approximately 15 feet. Existing monitoring well MW-7 will serve as the upgradient well while two monitoring wells will be installed downgradient at approximately 25 feet and 50 feet from the injection gallery. Note that the test location (at MW-7) is within the hot spot where COC concentrations are high. Targeted reagent injections at this hot spot area and upgradient of the proposed PRB location are expected to promote reducing conditions in the groundwater (i.e., turn anaerobic) before it travels toward and enters the PRB which is desirable for optimum dechlorination. The pilot reagent injections are expected to last for three to five years, although pilot testing will be limited to approximately eight months. It is envisioned that the pilot scale location will become part of the proposed full scale injections after completion of pilot testing.

The pilot scale study will monitor for the following operational and performance monitoring parameters.

- Aquifer capacity to accept the reagents injected into the groundwater including the time required to inject a desired volume and reagent dilution required;
- Pressure or resistance associated with the injections and reagents injection rates;
- COC degradation and by-products formed;

- Organic carbon and iron (electron donor) distribution;
- Groundwater geochemistry changes and its role in dechlorination; and
- Microbial distribution post-augmentation.

The data collected from the above monitoring will help establish a design basis and prepare preliminary cost estimates for full scale in-situ treatment of soil and groundwater in the overburden hot spots.

OU4-1 (In-Situ Chemical Oxidation)

The objective of the pilot scale study is to evaluate the extent of degradation of Site COCs in the deep bedrock groundwater due to an aggressive ISCO remedy and to collect design parameters data in support of the proposed full scale ISCO remedy where bedrock groundwater is impacted with high COCs concentrations. The goal of ISCO remedy is to reduce groundwater contamination to meet UCL standards (TCE <=50,000 ug/L; PCBs <=100 ug/L). Sodium permanganate is the selected oxidant proven to degrade TCE and its potential by-products.

The location proposed for the in-situ pilot study is the vicinity of MW-26B and covers a plume area of approximately 60 feet (wide) x 100 feet (length) with treatment depth in the deep bedrock from 46 to 89 feet below ground surface. Existing well MW-26B will serve as the downgradient monitoring well to measure the oxidant performance while one injection well and one extraction well will be installed in the vicinity of MW-26B to serve as a recirculation system. The ISCO remedy involves pulsed permanganate solution injections through one upgradient injection well combined with groundwater extraction with one extraction well to spread the oxidant. The groundwater recirculation will occur using the extraction/injection well network after pulsed permanganate solution injections to facilitate permanganate flow through the fractured rock. The ISCO recirculation design will be a combination of active and passive i.e., alternate between recirculation and shutdown to combine forced and natural groundwater flow. The pilot scale study is expected to last approximately eight months. It is envisioned that the pilot scale location will become part of the proposed full scale injection/extraction recirculation system after completion of pilot testing.

The pilot scale study will monitor for the following operational and performance monitoring parameters.

- Bedrock capacity to accept the oxidant injected into the groundwater including the time required to inject a desired volume and reagent dilution required;
- Pressure or resistance associated with the oxidant injections along with injection rates;
- Assay of permanganate native oxidant demand to determine dosing;
- COC degradation and by-products formed;
- Oxidant longevity and by-products, if any (manganese oxide); and
- Groundwater geochemistry changes and its influence on oxidant dosing and longevity.

The data collected from the above monitoring will help establish a design basis and perform preliminary cost estimates for full scale passive injection-extraction recirculation system for treatment of high groundwater COC concentrations in deep bedrock.

As noted above, the three pilot studies are each anticipated to last for approximately eight months. It is anticipated that these studies can be conducted concurrently.

Section 9

Phase III Completion Statement and LSP Opinion

This Phase III has been completed in accordance with the requirements of the MCP (310 CMR 40) and meets the Remedial Action Performance Standards and Phase III Performance Standards as defined in 310 CMR 40.0853. Remedial action alternatives have been evaluated that are reasonably likely to achieve a condition of No Significant Risk. The recommended remedial action alternative is anticipated to achieve a Permanent Solution and will reduce the concentrations of oil and hazardous materials to levels that support a condition of No Significant Risk. Reducing concentrations to levels that achieve or approach background have been determined to be infeasible based on the persistent nature or the COCs and the subsurface conditions at the site. A comprehensive remedial action alternative has been selected based on the information and evaluation documented in this Phase III RAP and will include the following:

- Removal and consolidation or off-site disposal of impacted soils above UCLs or within the top 2 feet bgs on the Titleist property, followed by soil capping and landscape restoration
- For the remainder of the Site, capping with an asphalt cap for areas with soil above 2 mg/kg of PCBs and with an Engineered Barrier for soils in the top 15 feet bgs with PCBs above UCLs, consistent with the MassDEP Engineered Barrier Guidance and the EPA TSCA Determination
- Containment of impacted groundwater along the north and south Aerovox boundaries through installation of a vertical barrier
- Treatment of overburden groundwater through in situ treatment of the source/hot spot portion of the plume and installation of a permeable reactive barrier at the eastern boundary of the site between the site and the Acushnet River
- Elimination of the on-site storm sewer system as a potential preferential pathway for contaminant migration by cleaning and lining, or where necessary replacing the storm sewer lines, manholes and catch basins
- Treatment of hot spot bedrock groundwater areas impacted above UCL levels through in situ application of reagents.
- Monitored natural attenuation of the groundwater/subslab soil gas/indoor air pathway at the Precix property.
- Implementation of Activity and Use Limitations on all three properties to restrict foreseeable future use and provide for long term monitoring and maintenance of the response actions.

Implementation of these response actions, after a period of remedy operation, will lead to a condition of No Significant Risk and a Permanent Solution.

Section 10

Public Notifications

The MCP (310 CMR 40.1403(3)(e)) requires written notice be made upon the completion of a Phase III Remedial Action Plan. This written notice is to be provided to the Chief Municipal Officer and Board of Health in the community where the site is located. Copies of the written notice letters to public officials are provided in Appendix E, and have been sent to the City of New Bedford concurrent with submittal of this Phase III RAP.

Section 11

Limitations

This document was prepared solely for AVX Corporation in accordance with professional standards at the time the services were performed and in accordance with the contract between AVX Corporation and Brown and Caldwell. This document is governed by the specific scope of work authorized by AVX; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work.

Section 12

References

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7/28/2016

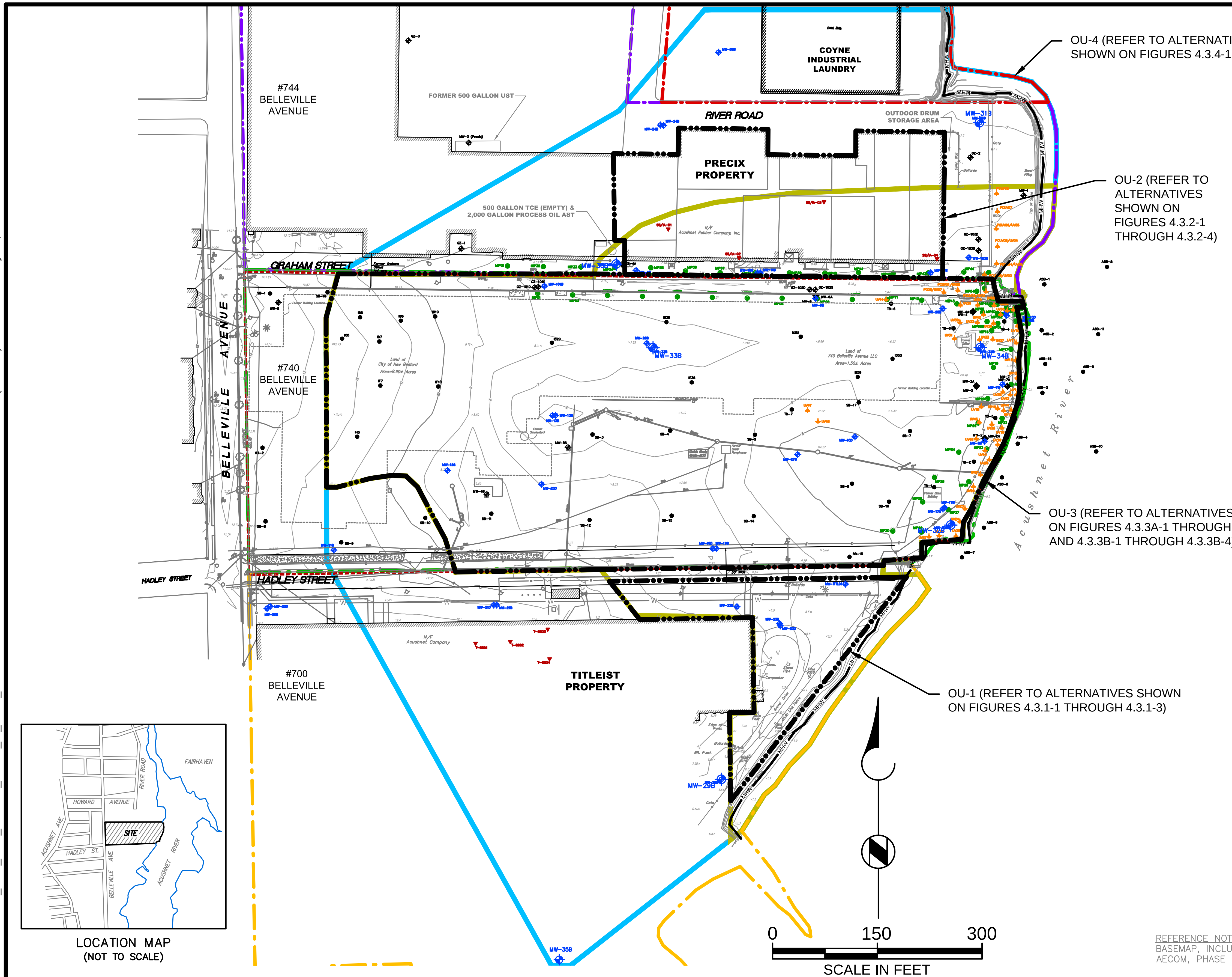
Path: C:\Users\gavruskin\Desktop\afcure_Base.mxd

Author: Brown and Caldwell

Brown AND Caldwell

Figure 2-1
Site Location Plan
Aerovox Facility
740 Belleville Avenue, New Bedford, MA

0 1,000 2,000
Feet



LEGEND

- MONITORING WELL (AECOM)
- SOIL BORING (AECOM)
- MIP BORING (AECOM)
- INDOOR AIR/SUB SLAB VAPOR POINT (AECOM)
- UVOST BORING (AECOM)
- HISTORIC SOIL BORING INSTALLED BY OTHERS*
- HISTORIC MONITORING WELL INSTALLED BY OTHERS*
- AEROVOX PROPERTY LINE
- CURRENT RTN SITE BOUNDARY BASED ON SOIL RESULTS FROM PHASE II CSA
- INFERRED SITE BOUNDARY BASED ON GROUNDWATER PLUME CONCENTRATIONS
- PRECIX PROPERTY LINE
- TITLEIST PROPERTY LINE
- COYNE INDUSTRIAL LAUNDRY PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- MHW — MEAN HIGH WATER
- 7 — GROUND ELEVATIONS CONTOUR (NVGD 1929)

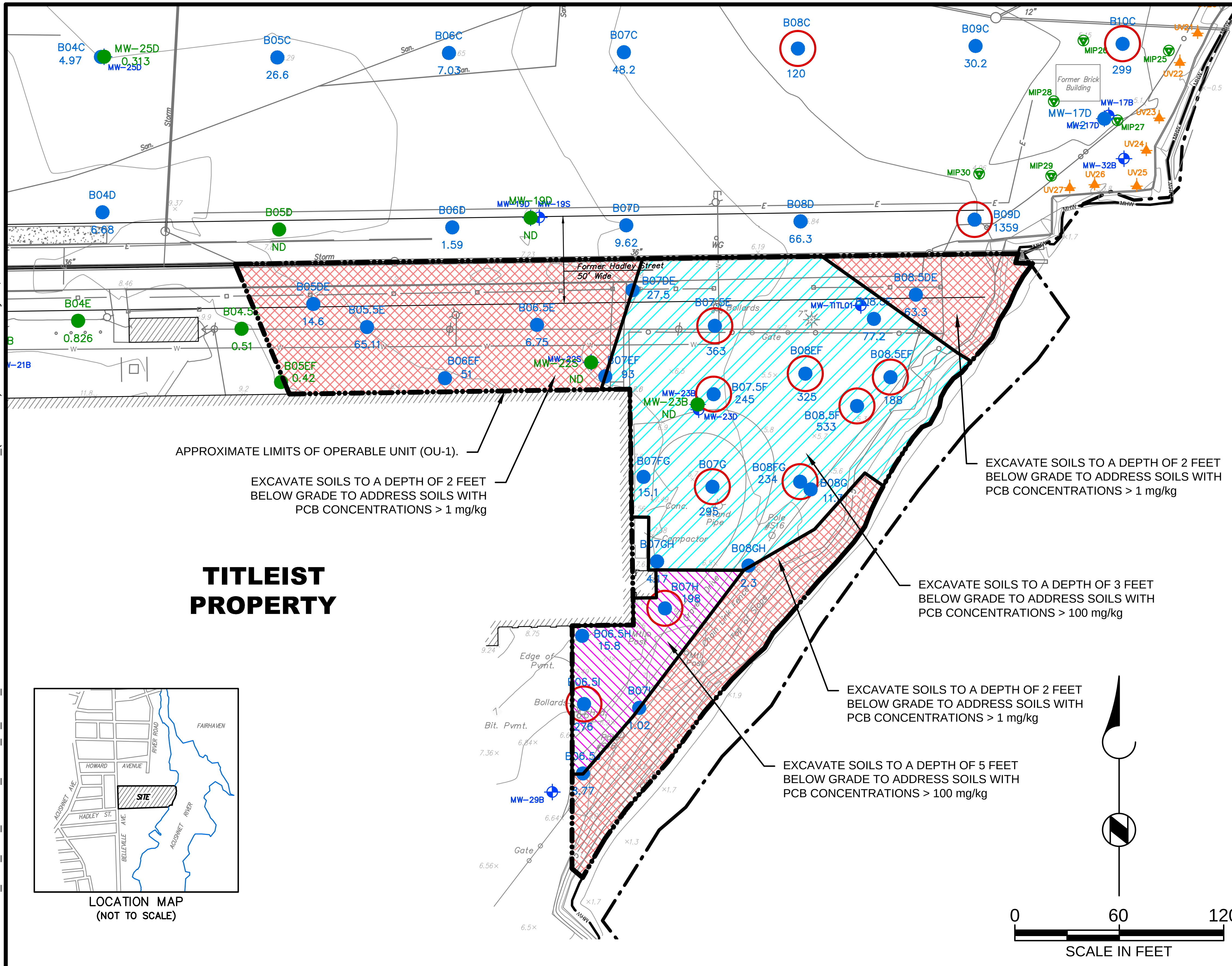
NOTES:

1. OU-1 IS COMPRISED OF SURFACE SOILS ABOVE THE PEAT LAYER WITHIN THE EASTERN UNPAVED LANDSCAPED AREA OF THE ACUSHNET/TITLEIST PROPERTY.
2. OU-2 IS COMPRISED OF THE SUBSURFACE SOIL AND SHALLOW OVERBURDEN GROUNDWATER ON THE PRECIX PROPERTY THAT MAY CONTRIBUTE TO FUTURE RISK RESULTING FROM A COMPLETE VAPOR INTRUSION PATHWAY.
3. OU-3 IS COMPRISED OF THE SOURCE AREA SOIL, STORM SEWERS, AND OVERBURDEN GROUNDWATER.
4. OU-4 IS COMPRISED OF SHALLOW AND DEEP BEDROCK GROUNDWATER IMPACTED BY PCBs, CVOCs, AND DNAPL.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

Brown AND Caldwell	SCALE: 1" = 150' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OVERALL SITE PLAN IDENTIFYING OPERABLE UNITS (OU'S)	FIGURE 2-2

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: Overall Site Plan (FIG 2-2) Plot Date: July 29, 2016 10:45 AM Cadd User: Adam Gutta



LEGEND

- ● SAMPLE LOCATION WITH TOTAL PCBs < 1 mg/kg
- 0.05 MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- ● SAMPLE LOCATION WITH TOTAL PCBs > 1 mg/kg
- 2.50 MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- ○ SAMPLE LOCATION WITH TOTAL PCBs > 100 mg/kg WITHIN A DEPTH OF 15 FEET BELOW GROUND SURFACE
- ND NOT DETECTED
- MEAN HIGH WATER
- PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- EXCAVATE TO 2 FEET BELOW GRADE
- EXCAVATE TO 3 FEET BELOW GRADE
- EXCAVATE TO 5 FEET BELOW GRADE

GENERAL CONSTRUCTION SEQUENCE:

1. EXCAVATE SOILS WITHIN THE AREAS SHOWN AND TO THE DEPTHS INDICATED ON THIS FIGURE
2. BACKFILL ALL EXCAVATIONS TO A DEPTH OF 2 FEET BGS WITH CERTIFIED CLEAN FILL MATERIALS
3. INSTALL DEMARCATION LAYER
4. BACKFILL ALL EXCAVATIONS TO FINAL GRADE WITH CERTIFIED CLEAN FILL MATERIALS
5. RESTORE AREA IN KIND
6. CHARACTERIZE AND DISPOSE OF EXCAVATED SOILS ONTO OU-3 OR AT AN OFF-SITE FACILITY(IES) LICENSED AND PERMITTED TO ACCEPT THE TYPE OF WASTE

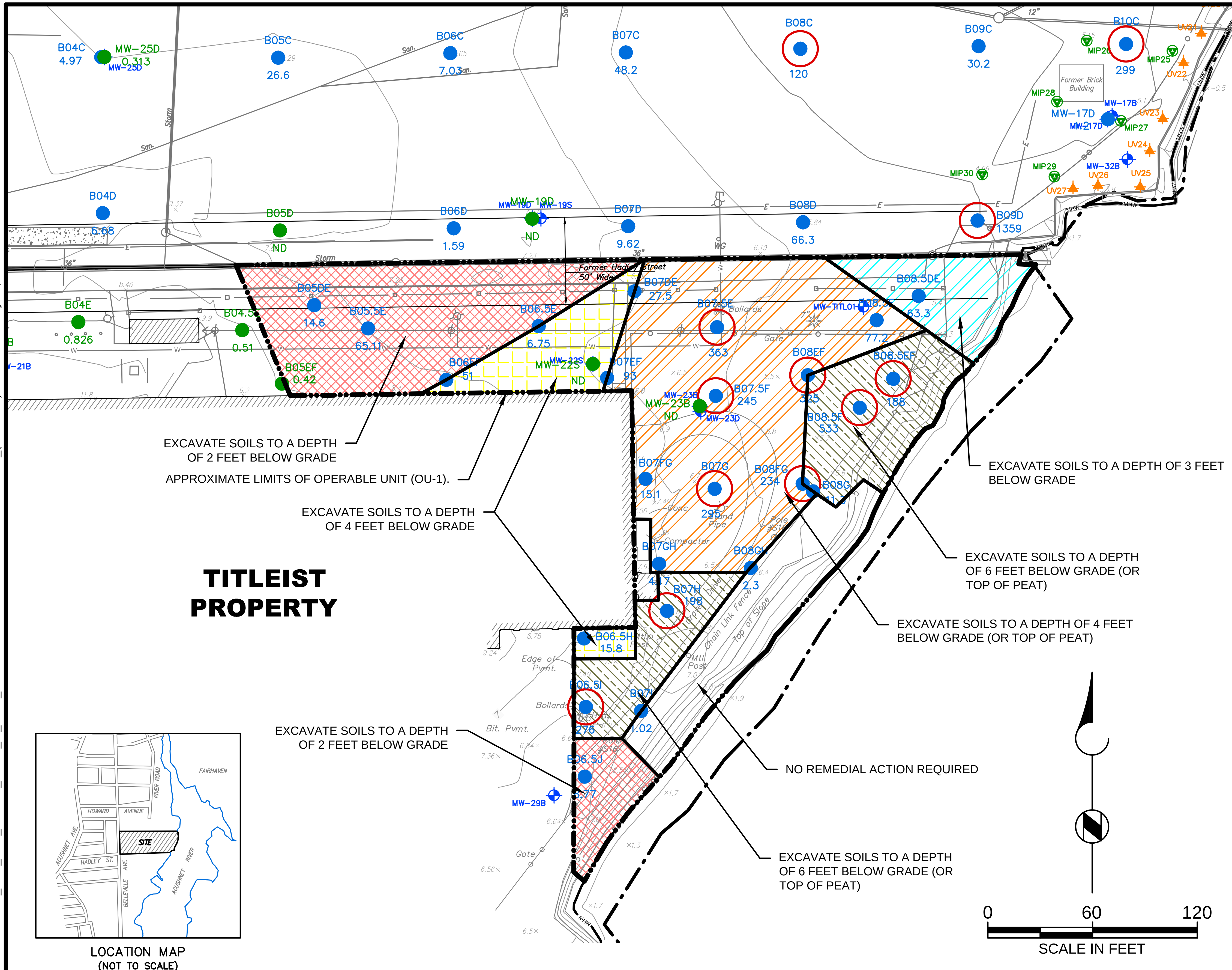
NOTES:

1. EXCAVATION ACTIVITIES WILL NOT BE CONDUCTED BELOW THE PEAT LAYER. IF THE PEAT LAYER IS ENCOUNTERED PRIOR TO REACHING THE NOTED EXCAVATION DEPTH, EXCAVATION ACTIVITIES WILL CEASE.
2. AN ACTIVITY AND USE LIMITATION (AUL) WILL BE ESTABLISHED OVER THE EXTENT OF OPERABLE UNIT (OU) 1 AS PART OF THE REMEDY.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

Brown AND Caldwell	SCALE: 1" = 60' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-1 (TITLEIST PROPERTY SOILS) ALTERNATIVE 1	FIGURE 4.3.1-1

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-1_(FIG 4.3.1) Plot Date: July 29, 2016 10:06 AM Cadd User: Adam Gutta



LEGEND

●	SAMPLE LOCATION WITH TOTAL PCBs < 1 mg/kg
0.05	MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
●	SAMPLE LOCATION WITH TOTAL PCBs > 1 mg/kg
2.50	MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
○	SAMPLE LOCATION WITH TOTAL PCBs > 100 mg/kg WITHIN A DEPTH OF 15 FEET BELOW GROUND SURFACE
ND	NOT DETECTED
MHW	MEAN HIGH WATER
	PROPERTY LINE
	APPROXIMATE OPERABLE UNIT BOUNDARY
	EXCAVATE TO 2 FEET BELOW GRADE
	EXCAVATE TO 3 FEET BELOW GRADE
	EXCAVATE TO 4 FEET BELOW GRADE (OR TOP OF PEAT)
	EXCAVATE TO 4 FEET BELOW GRADE
	EXCAVATE TO 6 FEET BELOW GRADE (OR TOP OF PEAT)

GENERAL CONSTRUCTION SEQUENCE:

1. EXCAVATE SOILS WITHIN THE AREAS SHOWN AND TO THE DEPTHS INDICATED ON THIS FIGURE TO ADDRESS SOILS WITH PCB CONCENTRATIONS > 4 MG/KG
2. BACKFILL ALL EXCAVATIONS TO A DEPTH OF 2 FEET BGS WITH CERTIFIED CLEAN FILL MATERIALS
3. INSTALL DEMARCATION LAYER
4. BACKFILL ALL EXCAVATIONS TO FINAL GRADE WITH CERTIFIED CLEAN FILL MATERIALS
5. RESTORE AREA IN KIND
6. CHARACTERIZE AND DISPOSE OF EXCAVATED SOILS ONTO OU-3 OR AT AN OFF-SITE FACILITY(IES) LICENSED AND PERMITTED TO ACCEPT THE TYPE OF WASTE

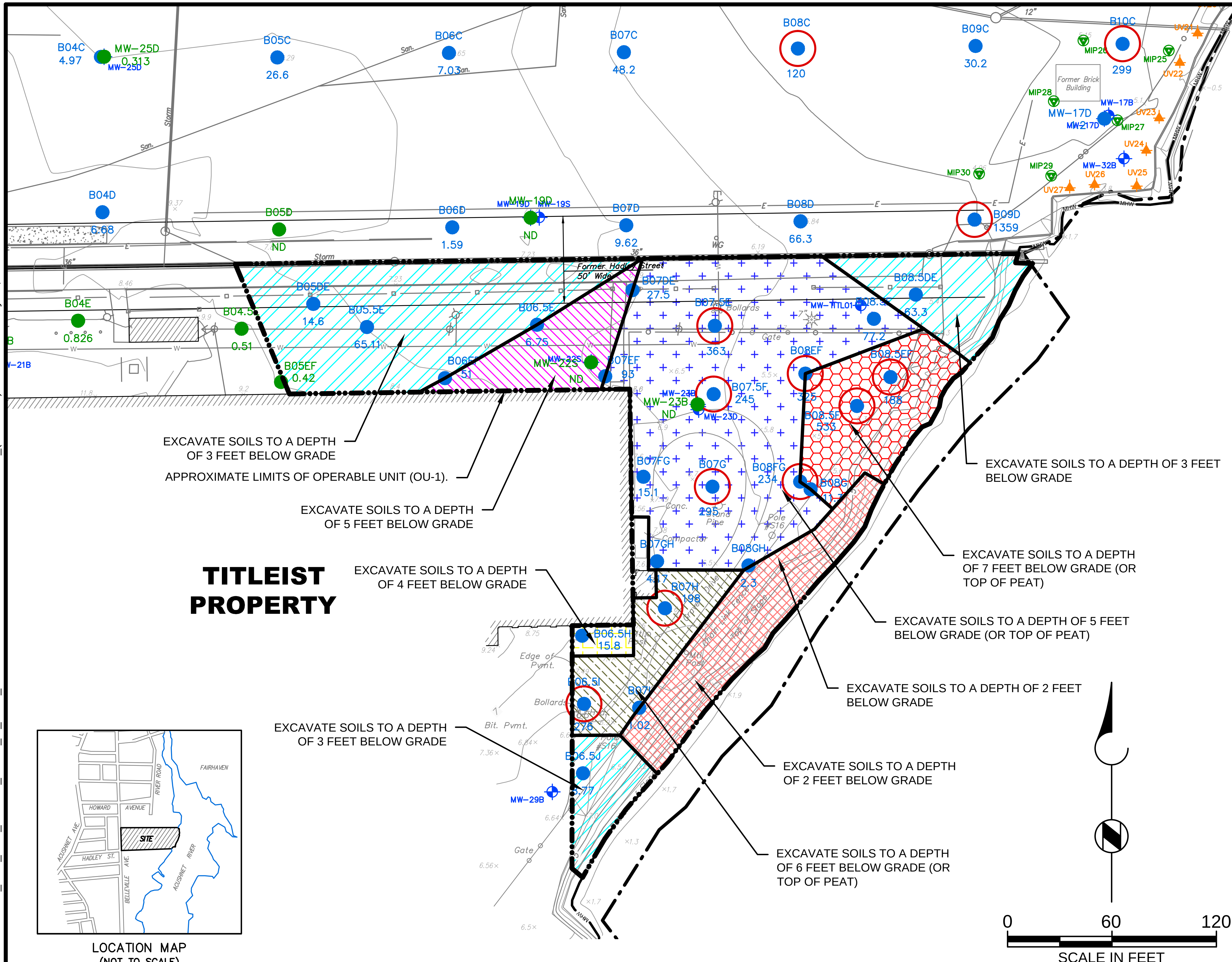
NOTES:

1. EXCAVATION ACTIVITIES WILL NOT BE CONDUCTED BELOW THE PEAT LAYER. IF THE PEAT LAYER IS ENCOUNTERED PRIOR TO REACHING THE NOTED EXCAVATION DEPTH, EXCAVATION ACTIVITIES WILL CEASE.
2. AN ACTIVITY AND USE LIMITATION (AUL) WILL BE ESTABLISHED OVER THE EXTENT OF OPERABLE UNIT (OU) 1 AS PART OF THE REMEDY.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

Brown AND Caldwell	SCALE: 1" = 60' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-1 (TITLEIST PROPERTY SOILS) ALTERNATIVE 2	FIGURE 4.3.1-2

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-1_(FIG 4.3.1) Plot Date: July 29, 2016 10:06 AM Cadd User: Adam Gutta



LEGEND

●	SAMPLE LOCATION WITH TOTAL PCBs < 1 mg/kg
0.05	MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
●	SAMPLE LOCATION WITH TOTAL PCBs > 1 mg/kg
2.50	MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
○	SAMPLE LOCATION WITH TOTAL PCBs > 100 mg/kg WITHIN A DEPTH OF 15 FEET BELOW GROUND SURFACE
ND	NOT DETECTED
MHW	MEAN HIGH WATER
	PROPERTY LINE
	APPROXIMATE OPERABLE UNIT BOUNDARY
	EXCAVATE TO 2 FEET BELOW GRADE
	EXCAVATE TO 3 FEET BELOW GRADE
	EXCAVATE TO 4 FEET BELOW GRADE
	EXCAVATE TO 5 FEET BELOW GRADE
	EXCAVATE TO 5 FEET BELOW GRADE (OR TOP OF PEAT)
	EXCAVATE TO 6 FEET BELOW GRADE (OR TOP OF PEAT)
	EXCAVATE TO 7 FEET BELOW GRADE (OR TOP OF PEAT)

GENERAL CONSTRUCTION SEQUENCE:

1. EXCAVATE SOILS WITHIN THE AREAS SHOWN AND TO THE DEPTHS INDICATED ON THIS FIGURE TO ADDRESS SOILS WITH PCB CONCENTRATIONS > 1 MG/KG (UNRESTRICTED USE)
2. BACKFILL ALL EXCAVATIONS TO FINAL GRADE WITH CERTIFIED CLEAN FILL MATERIALS
3. RESTORE AREA IN KIND
4. CHARACTERIZE AND DISPOSE OF EXCAVATED SOILS ONTO OU-3 OR AT AN OFF-SITE FACILITY(IES) LICENSED AND PERMITTED TO ACCEPT THE TYPE OF WASTE

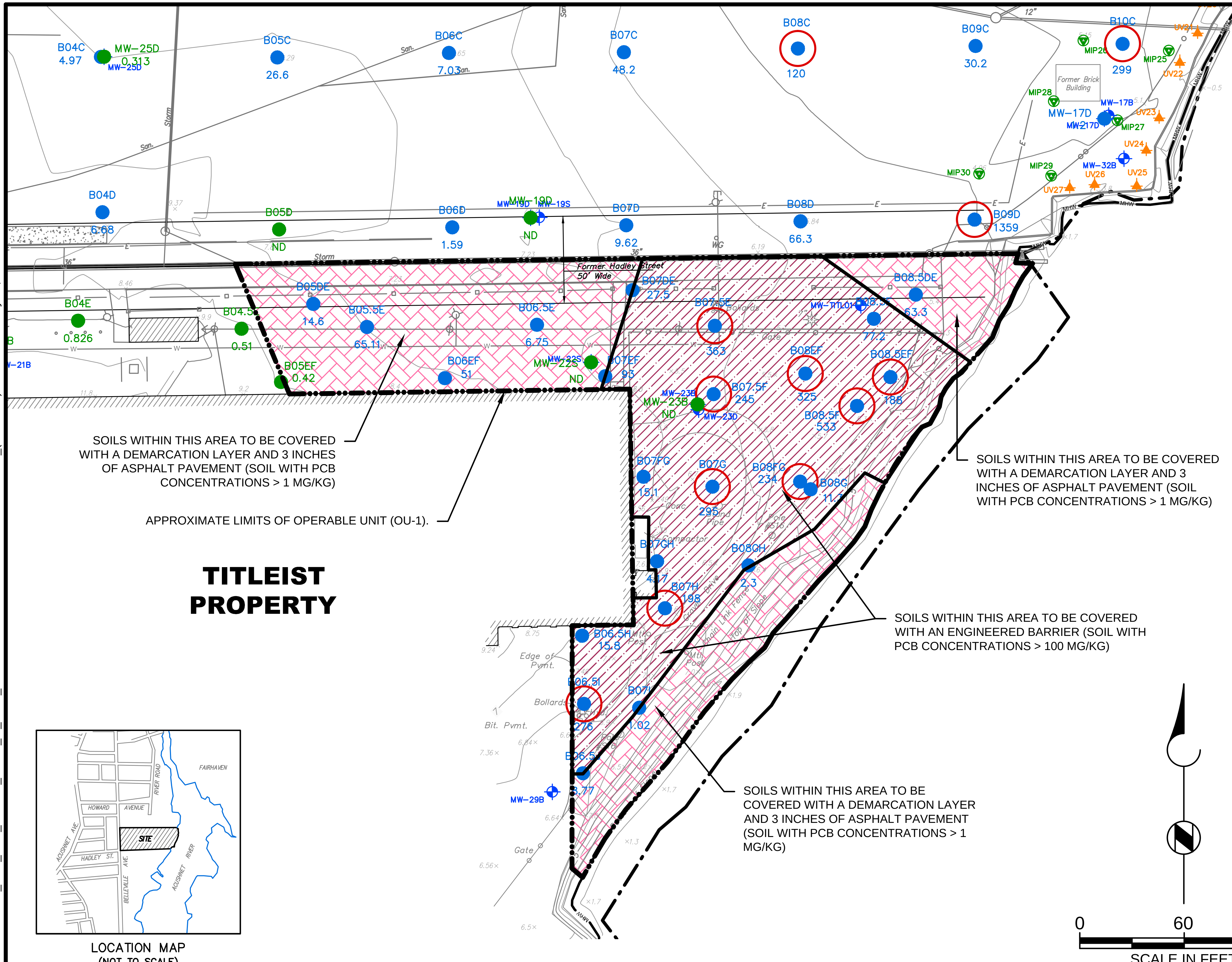
NOTES:

1. EXCAVATION ACTIVITIES WILL NOT BE CONDUCTED BELOW THE PEAT LAYER. IF THE PEAT LAYER IS ENCOUNTERED PRIOR TO REACHING THE NOTED EXCAVATION DEPTH, EXCAVATION ACTIVITIES WILL CEASE.
2. NO ACTIVITY AND USE LIMITATION (AUL) WILL BE REQUIRED OVER THE EXTENT OF OPERABLE UNIT (OU) 1 AS PART OF THE REMEDY.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

Brown AND Caldwell	SCALE: 1" = 60' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-1 (TITLEIST PROPERTY SOILS) ALTERNATIVE 3	FIGURE 4.3.1-3

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-1_(FIG 4.3.1) Plot Date: July 29, 2016 10:05 AM Cadd User: Adam Gutta



LEGEND

- ● SAMPLE LOCATION WITH TOTAL PCBs < 1 mg/kg
- 0.05 MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- ● SAMPLE LOCATION WITH TOTAL PCBs > 1 mg/kg
- 2.50 MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- ○ SAMPLE LOCATION WITH TOTAL PCBs > 100 mg/kg WITHIN A DEPTH OF 15 FEET BELOW GROUND SURFACE
- ND NOT DETECTED
- MHW MEAN HIGH WATER
- PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- ASPHALT COVER
- ENGINEERING BARRIER COVER

GENERAL CONSTRUCTION SEQUENCE:

1. INSTALL DEMARCATION LAYER AND PAVEMENT CAP OVER SOILS WITH PCB CONCENTRATIONS > 1 MG/KG.
2. INSTALL DEMARCATION LAYER AND ENGINEERED BARRIER AT LOCATIONS WITH PCB CONCENTRATIONS > 100 MG/KG.
3. CHARACTERIZE AND DISPOSE OF EXCAVATED SOILS ONTO OU-3 OR AT AN OFF-SITE FACILITY(IES) LICENSED AND PERMITTED TO ACCEPT THE TYPE OF WASTE

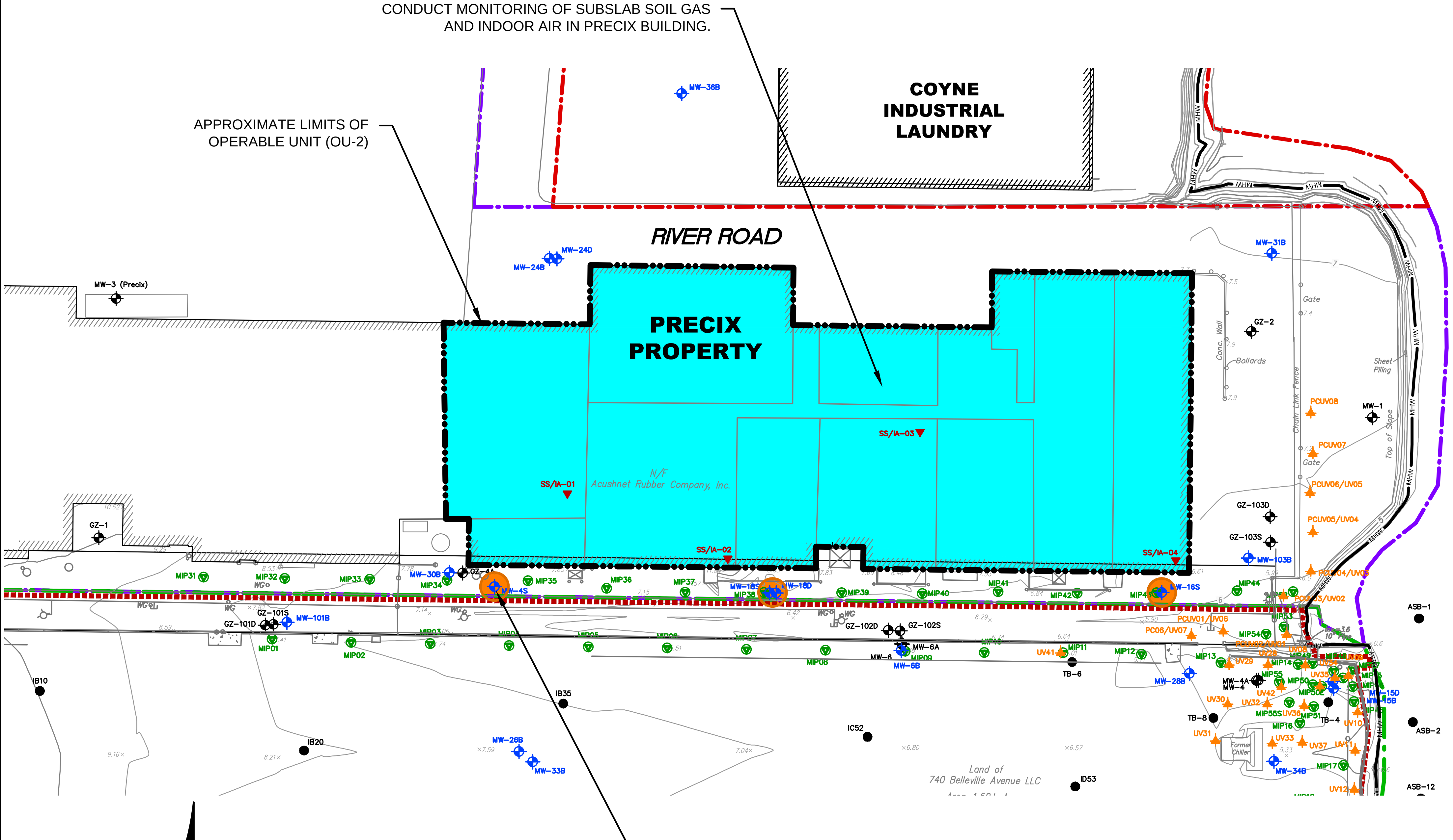
NOTES:

1. AN ACTIVITY AND USE LIMITATION (AUL) WILL BE ESTABLISHED OVER THE EXTENT OF OPERABLE UNIT (OU) 1 AS PART OF THE REMEDY.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

Brown AND Caldwell	SCALE: 1" = 60' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-1 (TITLEIST PROPERTY SOILS) ALTERNATIVE 4	FIGURE 4.3.1-4

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-1_(FIG 4.3.1) Plot Date: July 29, 2016 10:05 AM Cadd User: Adam Gutta



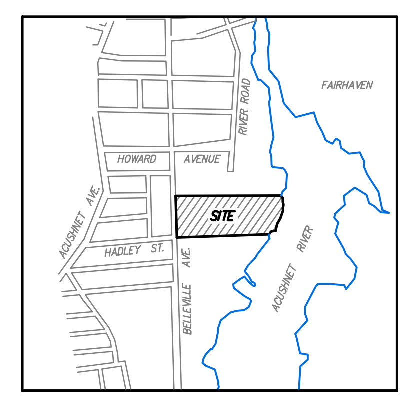
LEGEND

- MONITORING WELL (AECOM)
- SOIL BORING (AECOM)
- MIP BORING (AECOM)
- INDOOR AIR/SUB SLAB VAPOR POINT (AECOM)
- UVOST BORING (AECOM)
- HISTORIC SOIL BORING INSTALLED BY OTHERS*
- HISTORIC MONITORING WELL INSTALLED BY OTHERS*
- AEROVOX PROPERTY LINE
- RTN SITE BOUNDARY
- TITLEIST PROPERTY LINE
- COYNE INDUSTRIAL LAUNDRY PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- MEAN HIGH WATER
- MONITORING WELL TO WHICH MCP METHOD 1 GW–2 CRITERIA APPLY AND CONCENTRATION OF TRICHLOROETHENE IS ABOVE THE GW–2 VALUE OF 5 μg/L
- CONDUCT SEASONAL MONITORING OF SUBSLAB SOIL GAS AND INDOOR AIR

NOTES:

1. ALTERNATIVE 1 FOR OPERABLE UNIT 2 INCLUDES MONITORING SUBSLAB GAS ATTENUATION TO CONFIRM VAPOR INTRUSION DOES NOT PRESENT A SIGNIFICANT RISK FOR CURRENT OR FORESEEABLE FUTURE BUILDING OCCUPANTS.
2. AN AUL WILL BE ASSIGNED TO THE SITE TO RESTRICT BUILDING USE UNTIL ATTENUATION DEMONSTRATES VAPOR INTRUSION RELATED RESTRICTIONS ARE NO LINGER REQUIRED.
3. MONITORING OF GROUNDWATER, SUBSLAB SOIL GAS AND INDOOR AIR SHALL BE CONDUCTED WITHIN THE AREA OF THE PRECIX PROPERTY WHERE GW-2 APPLIES AND GROUNDWATER LEVELS ARE ABOVE CORRESPONDING GW-2 VALUES.

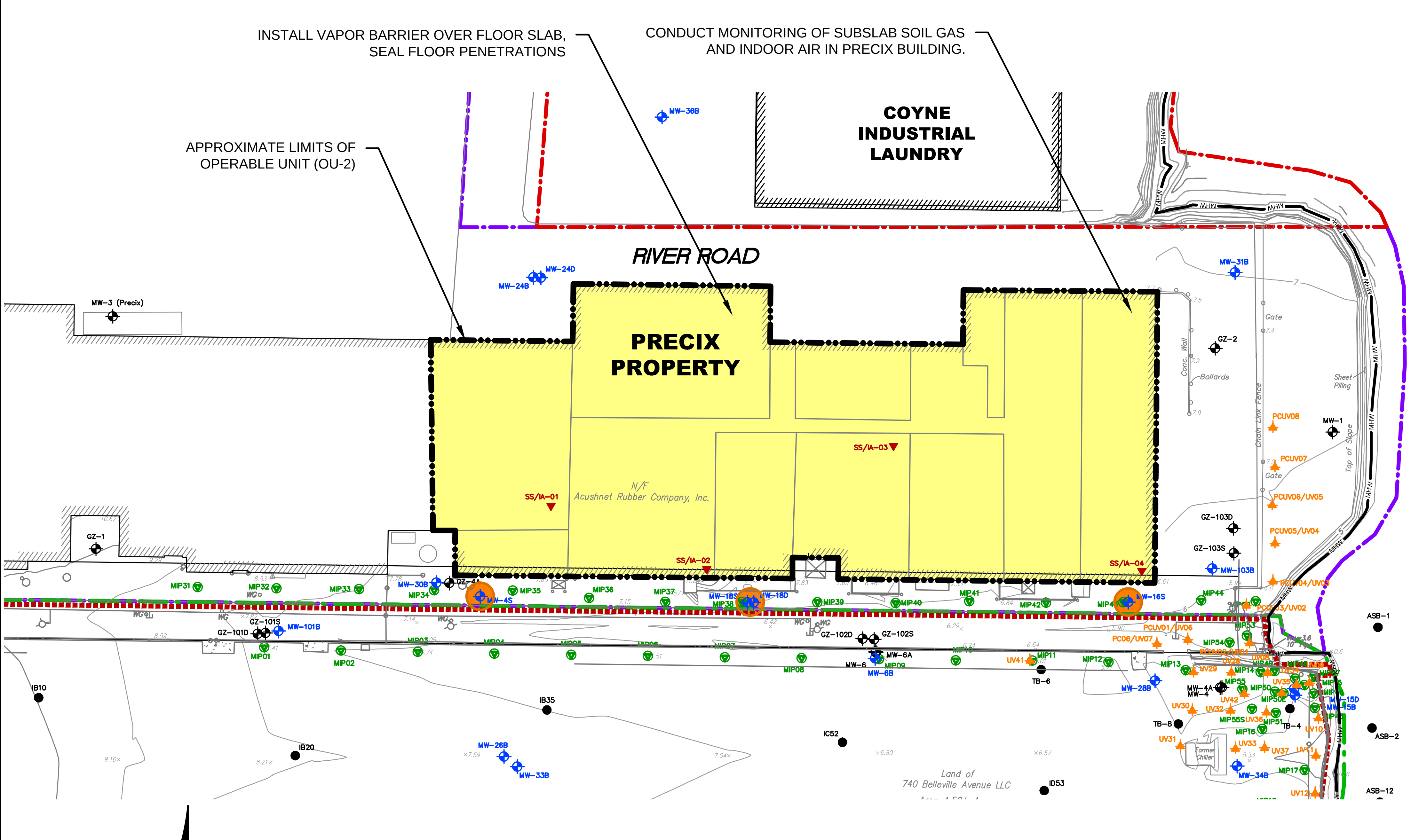
REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2–2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015



LOCATION MAP
(NOT TO SCALE)

Brown AND Caldwell	SCALE: 1" = 80' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-2 (PRECIX PROPERTY VAPOR INTRUSION) ALTERNATIVE 1	FIGURE 4.3.2-1

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CADI2-SHEETS\C-CIVIL File Name: OU-2_(FIG 4.3.2) Plot Date: July 29, 2016 10:08 AM Cadd User: Adam Gutta



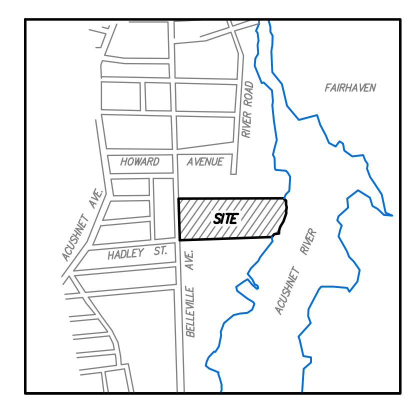
LEGEND

- MONITORING WELL (AECOM)
- SOIL BORING (AECOM)
- MIP BORING (AECOM)
- INDOOR AIR/SUB SLAB VAPOR POINT (AECOM)
- UVOST BORING (AECOM)
- HISTORIC SOIL BORING INSTALLED BY OTHERS*
- HISTORIC MONITORING WELL INSTALLED BY OTHERS*
- AEROVOX PROPERTY LINE
- RTN SITE BOUNDARY
- TITLEIST PROPERTY LINE
- COYNE INDUSTRIAL LAUNDRY PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- MEAN HIGH WATER
- MONITORING WELL TO WHICH MCP METHOD 1 GW-2 CRITERIA APPLY AND CONCENTRATION OF TRICHLOROETHENE IS ABOVE THE GW-2 VALUE OF 5 µg/L
- INSTALL VAPOR BARRIER OVER FLOOR SLAB

NOTES:

1. THIS ALTERNATIVE INCLUDES INSTALLATION OF A VAPOR BARRIER OVER A PORTION OF THE PRECIX BUILDING FLOOR SLAB AND ALL FLOOR PENETRATIONS TO RESTRICT FUTURE VAPOR INTRUSION.
2. ANNUAL MONITORING OF SUBSLAB SOIL GAS AND INDOOR AIR SHALL BE CONDUCTED WITHIN THE AREA OF THE PRECIX PROPERTY WHERE GROUNDWATER CONTAMINANT CONCENTRATIONS ARE ABOVE CORRESPONDING GW-2 VALUES.
3. AUL WILL BE PROVIDED ON IMPACTED PORTION OF PROPERTY TO RESTRICT FORESEEABLE FUTURE BUILDING USES AND TO PROVIDE FOR CONTINUED MONITORING, INSPECTION AND MAINTENANCE OF THE VAPOR BARRIER.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015



LOCATION MAP
(NOT TO SCALE)

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CADI2-SHEETS\C-CIVIL File Name: OU-2_(FIG 4.3.2) Plot Date: July 29, 2016 10:08 AM Cadd User: Adam Gutta

Brown AND Caldwell

SCALE: 1" = 80'

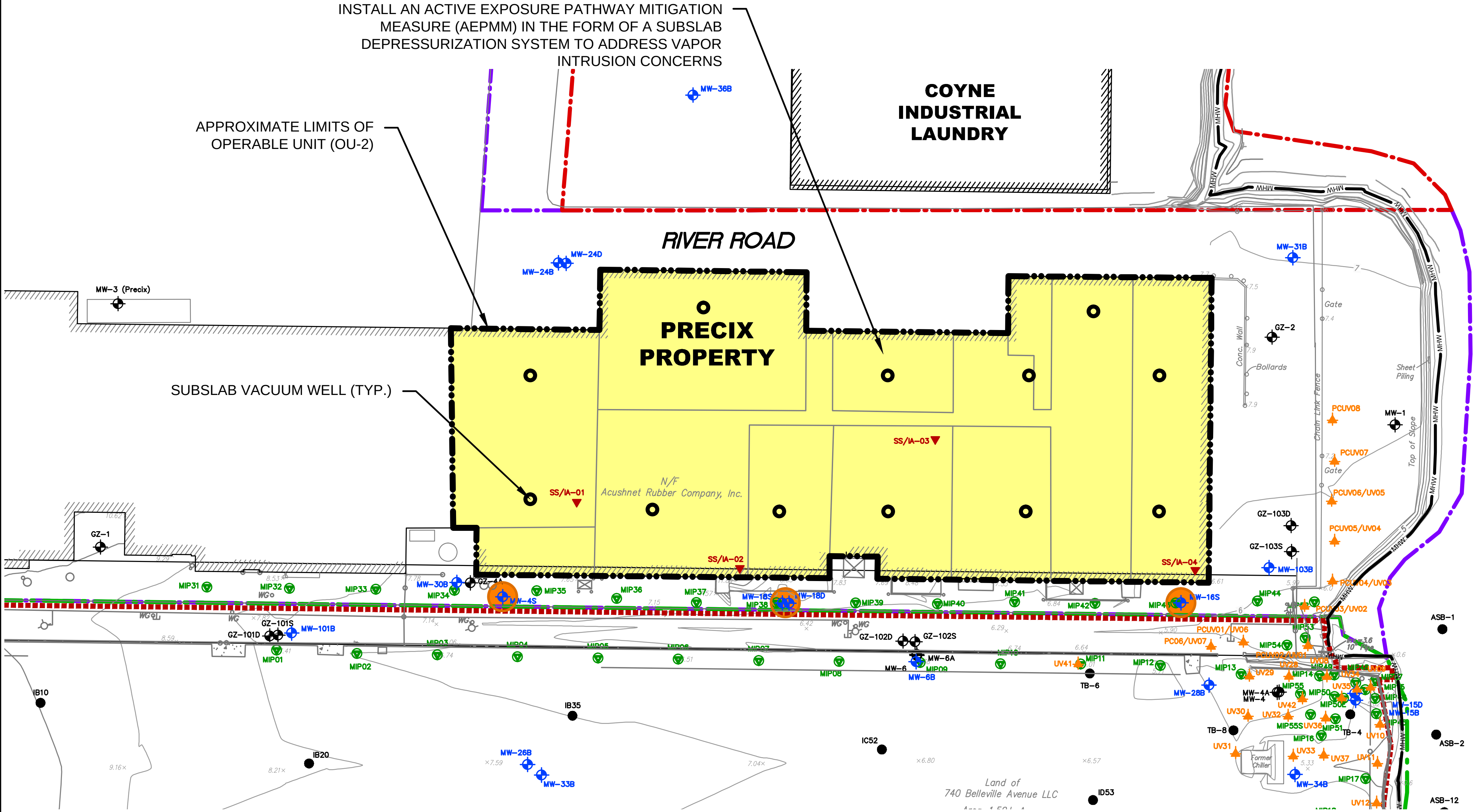
149339

DATE: July 29, 2016

AVX CORPORATION
740 BELLEVILLE AVENUE
NEW BEDFORD, MA

FORMER AEROVOX FACILITY
OU-2
(PRECIX PROPERTY VAPOR INTRUSION)
ALTERNATIVE 2

FIGURE
4.3.2-2



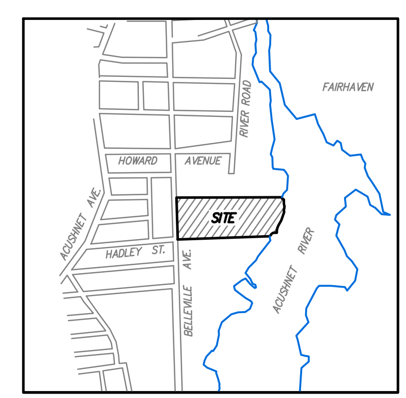
LEGEND

- MONITORING WELL (AECOM)
- SOIL BORING (AECOM)
- MIP BORING (AECOM)
- INDOOR AIR/SUB SLAB VAPOR POINT (AECOM)
- UVOST BORING (AECOM)
- HISTORIC SOIL BORING INSTALLED BY OTHERS*
- HISTORIC MONITORING WELL INSTALLED BY OTHERS*
- AEROVOX PROPERTY LINE
- RTN SITE BOUNDARY
- TITLEIST PROPERTY LINE
- COYNE INDUSTRIAL LAUNDRY PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- MEAN HIGH WATER
- MONITORING WELL TO WHICH MCP METHOD 1 GW-2 CRITERIA APPLY AND CONCENTRATION OF TRICHLOROETHENE IS ABOVE THE GW-2 VALUE OF 5 μg/L
- INSTALL SUBSLAB DEPRESSURIZATION SYSTEM
- SUBSLAB VACUUM WELL (TYP.)

NOTES:

1. THIS ALTERNATIVE INCLUDES INSTALLATION OF AN ACTIVE SUBSLAB DEPRESSURIZATION SYSTEM (ACTIVE EXPOSURE PATHWAY MITIGATION MEASURE OR AEPMM) WITHIN THE AREA OF THE PRECIX PROPERTY WHERE GW-2 APPLIES AND GROUNDWATER CONTAMINANT CONCENTRATIONS ARE ABOVE APPLICABLE GW-2 VALUES.
2. CONFIRMATORY MONITORING OF PRESSURE DIFFERENTIAL ACROSS BUILDING SLAB SHALL BE CONDUCTED.
3. AUL WILL BE PROVIDED ON IMPACTED PORTION OF PROPERTY TO RESTRICT FORESEEABLE FUTURE BUILDING USES AND TO PROVIDE FOR CONTINUED OPERATION AND MAINTENANCE OF THE AEPMM.
4. THE SUBSLAB VACUUM WELL LAYOUT WILL FINALIZED BASED ON THE OBSERVED RADIUS OF INFLUENCE.
5. AEPMM WILL INCLUDE REMOTE TELEMETRY.

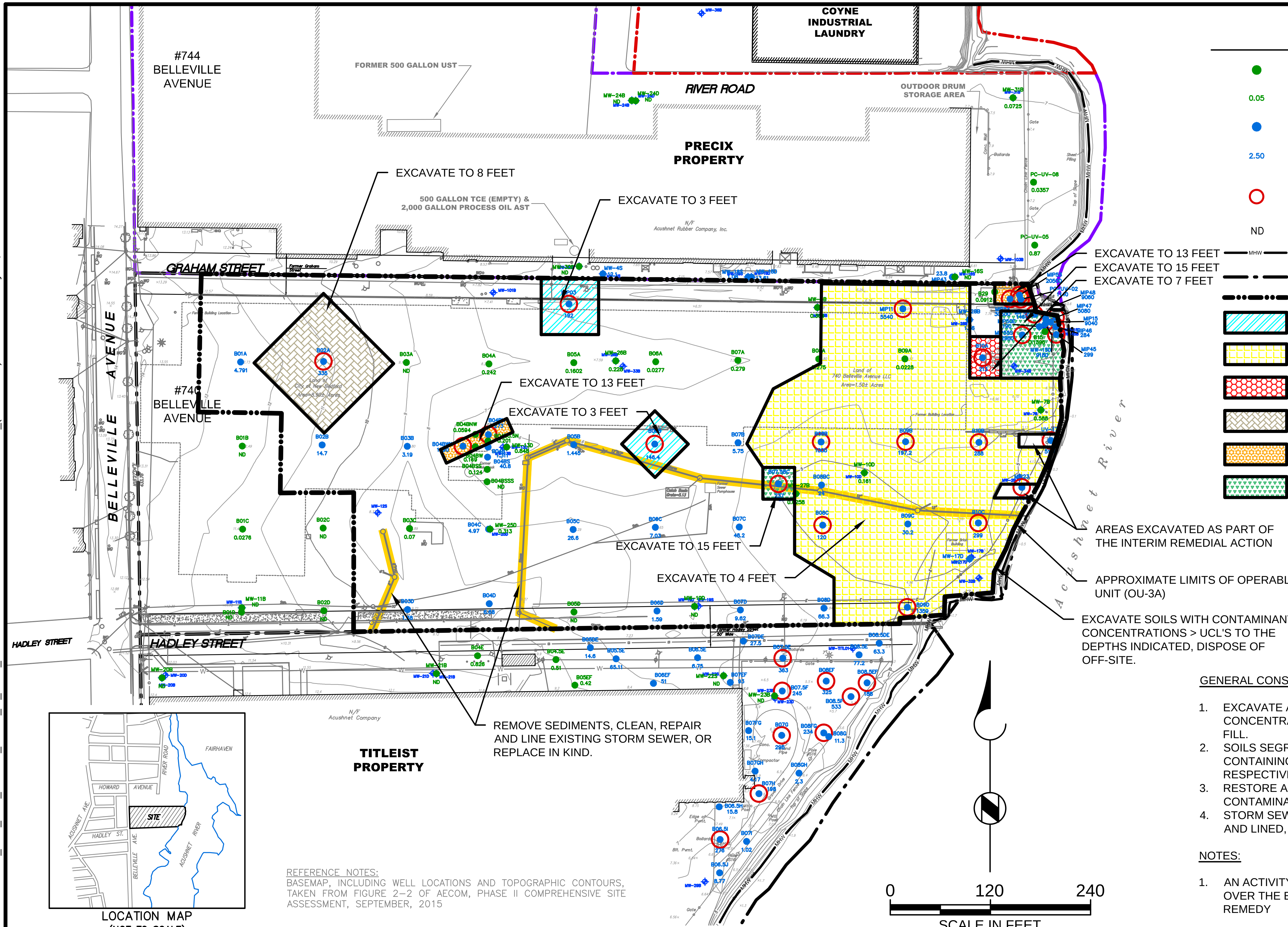
REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015



LOCATION MAP
(NOT TO SCALE)

Brown AND Caldwell	SCALE: 1" = 80' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-2 (PRECIX PROPERTY VAPOR INTRUSION) ALTERNATIVE 3	FIGURE 4.3.2-3

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CADI2-SHEETS\C-CIVIL File Name: OU-2_(FIG 4.3.2) Plot Date: July 29, 2016 10:09 AM Cadd User: Adam Gutta



REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

LEGEND

- SAMPLE LOCATION WITH TOTAL PCBs < 1 mg/kg
- 0.05 — MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- SAMPLE LOCATION WITH TOTAL PCBs > 1 mg/kg
- 2.50 — MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- SAMPLE LOCATION WITH TOTAL PCBs > 100 mg/kg WITHIN A DEPTH OF 15 FEET BELOW GROUND SURFACE
- ND — NOT DETECTED
- MHW — MEAN HIGH WATER
- PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- EXCAVATE TO 3 FEET BELOW GRADE
- EXCAVATE TO 4 FEET BELOW GRADE
- EXCAVATE TO 7 FEET BELOW GRADE
- EXCAVATE TO 8 FEET BELOW GRADE
- EXCAVATE TO 13 FEET BELOW GRADE
- EXCAVATE TO 15 FEET BELOW GRADE

GENERAL CONSTRUCTION SEQUENCE:

1. EXCAVATE AND DISPOSE SOILS WITH CONTAMINANT CONCENTRATIONS > UCL'S OFF-SITE, BACKFILL WITH CLEAN FILL.
2. SOILS SEGREGATED BASED ON CONCENTRATION WITH THOSE CONTAINING CONTAMINANTS CONCENTRATIONS BELOW THEIR RESPECTIVE UCL'S RETURNED TO EXCAVATION.
3. RESTORE ASPHALT CAP WHERE RESIDUAL PCB CONTAMINATION AT ANY DEPTH EXCEEDS 2 MG/KG.
4. STORM SEWERS WILL BE CLEANED OF SEDIMENT, REPAIRED AND LINED, OR SECTIONS REPLACED OR RECONFIGURED.

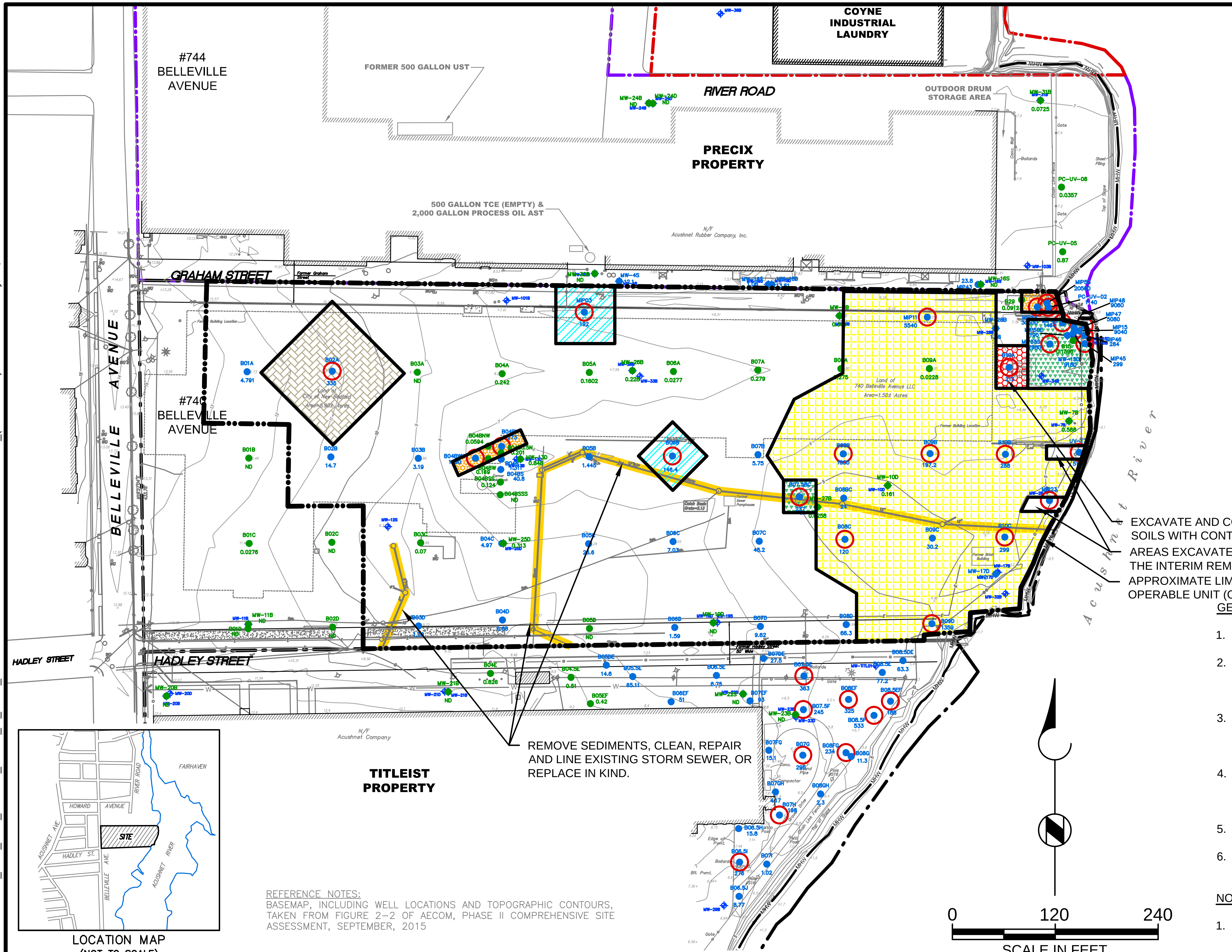
NOTES:

1. AN ACTIVITY AND USE LIMITATION (AUL) WILL BE ESTABLISHED OVER THE EXTENT OF OPERABLE UNIT (OU) 3 AS PART OF THE REMEDY

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CADI2-SHEETS\C-CIVIL File Name: OU-3A_(FIG 4.3.3A) Plot Date: July 29, 2016 10:34 AM Cadd User: Adam Gutta

Brown AND Caldwell	SCALE: 1" = 120' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-3A (AEROVOX PROPERTY SOILS) ALTERNATIVE 1	FIGURE 4.3.3A-1

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-3A_(FIG 4.3.3A) Plot Date: July 29, 2016 10:34 AM Cadd User: Adam Gutta



LEGEND

- SAMPLE LOCATION WITH TOTAL PCBs < 1 mg/kg
- 0.05 — MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- SAMPLE LOCATION WITH TOTAL PCBs > 1 mg/kg
- 2.50 — MAXIMUM TOTAL PCBs CONCENTRATION DETECTED AT LOCATION (ALL DEPTHS)
- SAMPLE LOCATION WITH TOTAL PCBs > 100 mg/kg WITHIN A DEPTH OF 15 FEET BELOW GROUND SURFACE
- ND — NOT DETECTED
- MEAN HIGH WATER
- PROPERTY LINE
- APPROXIMATE OPERABLE UNIT BOUNDARY
- EXCAVATE TO 3 FEET BELOW GRADE
- EXCAVATE TO 4 FEET BELOW GRADE
- EXCAVATE TO 7 FEET BELOW GRADE
- EXCAVATE TO 8 FEET BELOW GRADE
- EXCAVATE TO 13 FEET BELOW GRADE
- EXCAVATE TO 15 FEET BELOW GRADE

GENERAL CONSTRUCTION SEQUENCE:

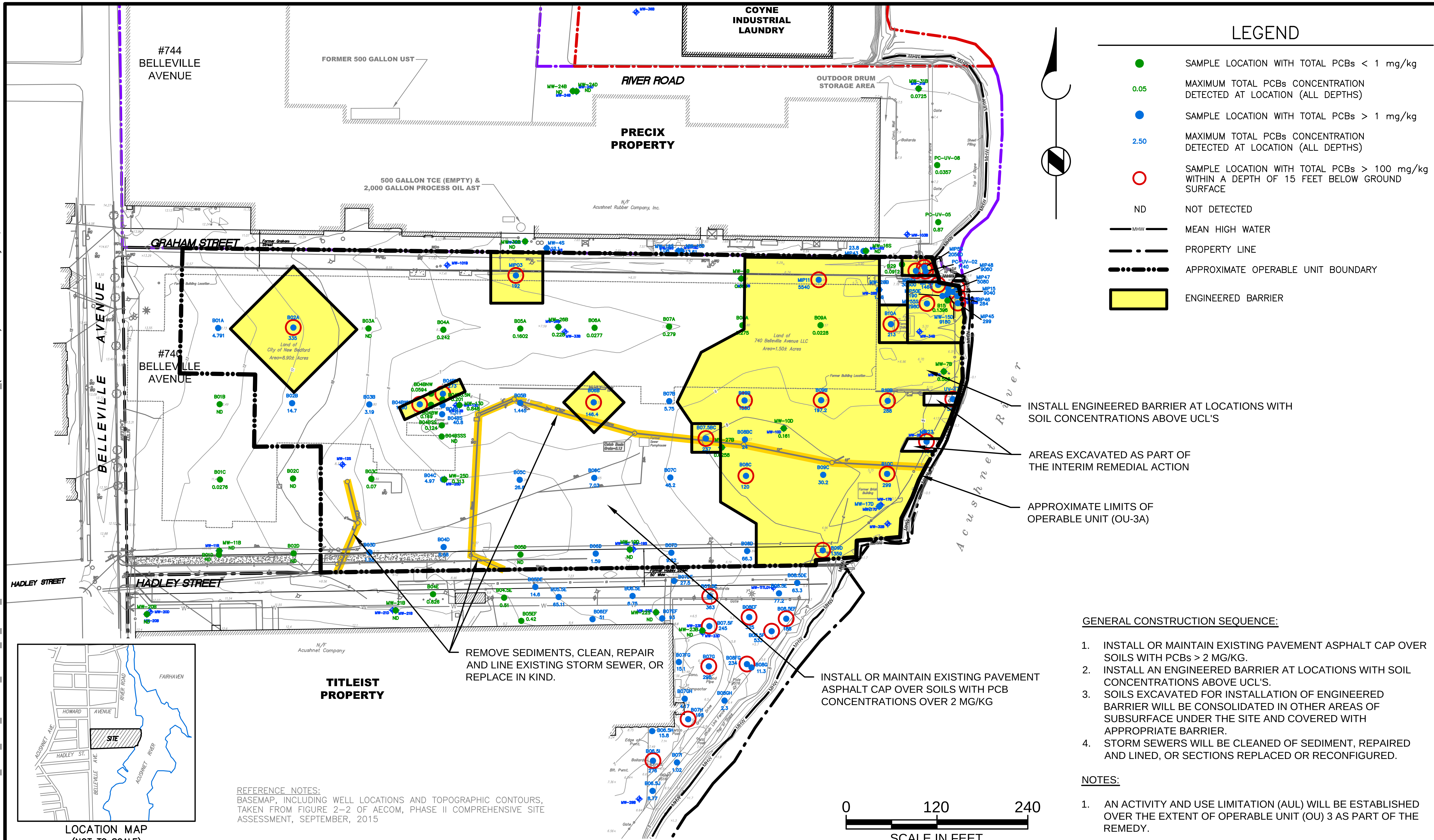
1. EXCAVATE AND CONDUCT EX-SITU TREATMENT OF SOILS WITH CONTAMINANT CONCENTRATIONS > UCL'S.
2. SOILS SEGREGATED BASED ON CONCENTRATION WITH THOSE CONTAINING CONTAMINANTS CONCENTRATIONS BELOW THEIR RESPECTIVE UCL'S RETURNED TO EXCAVATION WITHOUT TREATMENT.
3. SOILS WITH CONCENTRATIONS ABOVE UCL LEVELS TREATED ON SITE USING EITHER BIOLOGICAL, CHEMICAL OR THERMAL TREATMENT (TREATMENT SELECTION BASED ON BENCH/PILOT STUDY RESULTS).
4. THE EXCAVATED AREAS WILL BE BACKFILLED WITH EITHER SOILS WITH CONTAMINANT CONCENTRATIONS BELOW RESPECTIVE UCL'S, TREATED SOIL, OR CLEAN IMPORTED BACKFILL.
5. ASPHALT CAP RESTORED WHERE RESIDUAL PCB CONTAMINATION AT ANY DEPTH EXCEEDS 2 MG/KG.
6. STORM SEWERS WILL BE CLEANED OF SEDIMENT, REPAIRED AND LINED, OR SECTIONS REPLACED OR RECONFIGURED.

NOTES:

1. AN ACTIVITY AND USE LIMITATION (AUL) WILL BE ESTABLISHED OVER THE EXTENT OF OPERABLE UNIT (OU) 3 AS PART OF THE REMEDY.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

Brown AND Caldwell	SCALE: 1" = 120' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-3A (AEROVOX PROPERTY SOILS) ALTERNATIVE 2	FIGURE 4.3.3A-2



GENERAL CONSTRUCTION SEQUENCE:

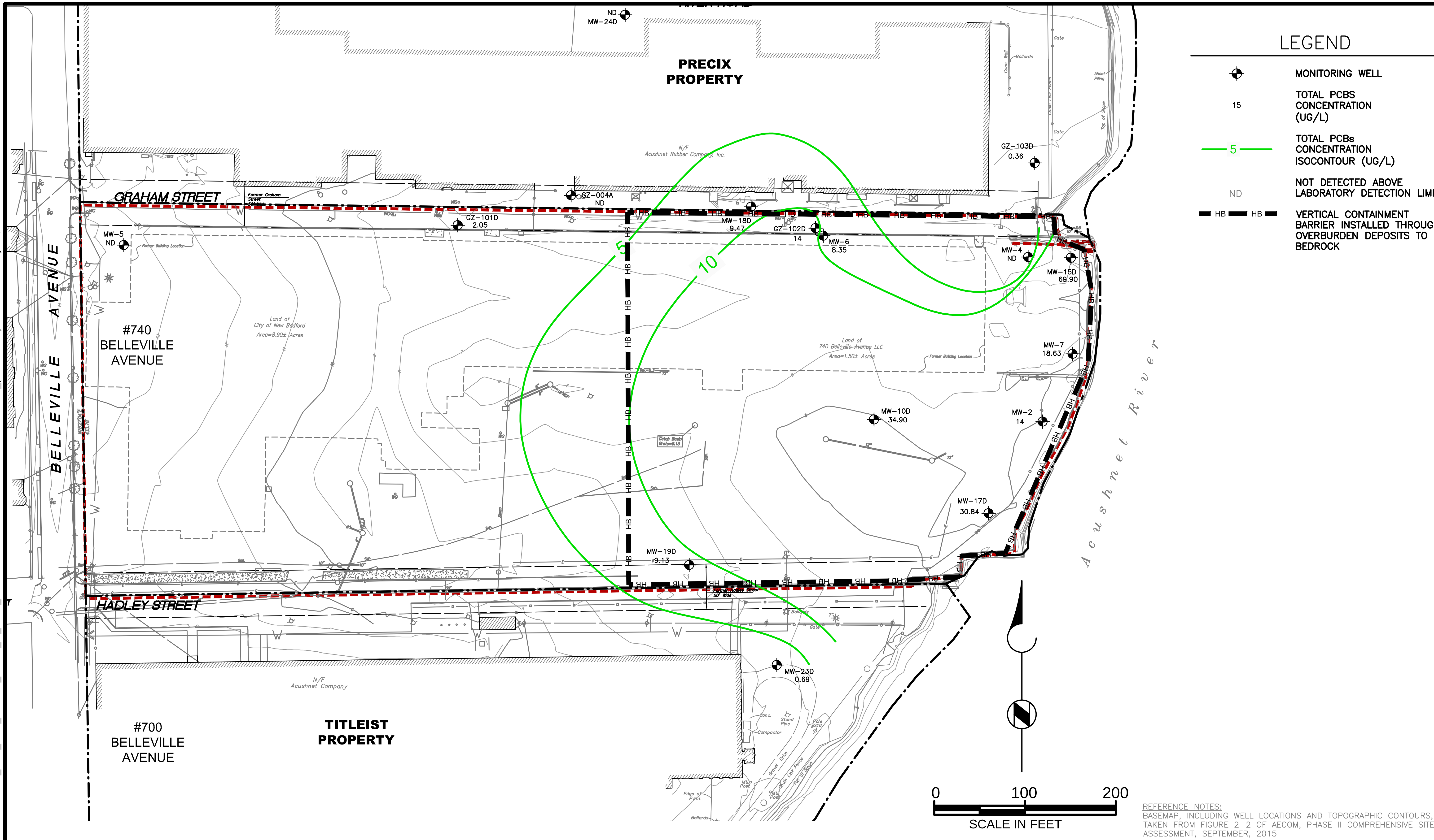
1. INSTALL OR MAINTAIN EXISTING PAVEMENT ASPHALT CAP OVER SOILS WITH PCBs > 2 MG/KG.
2. INSTALL AN ENGINEERED BARRIER AT LOCATIONS WITH SOIL CONCENTRATIONS ABOVE UCL'S.
3. SOILS EXCAVATED FOR INSTALLATION OF ENGINEERED BARRIER WILL BE CONSOLIDATED IN OTHER AREAS OF SUBSURFACE UNDER THE SITE AND COVERED WITH APPROPRIATE BARRIER.
4. STORM SEWERS WILL BE CLEANED OF SEDIMENT, REPAIRED AND LINED, OR SECTIONS REPLACED OR RECONFIGURED.

NOTES:

1. AN ACTIVITY AND USE LIMITATION (AUL) WILL BE ESTABLISHED OVER THE EXTENT OF OPERABLE UNIT (OU) 3 AS PART OF THE REMEDY.

Brown AND Caldwell	SCALE: 1" = 120' 149339 DATE: July 29, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-3A (AEROVOX PROPERTY SOILS) ALTERNATIVE 3	FIGURE 4.3.3A-3

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-3A_(FIG 4.3.3A) Plot Date: July 29, 2016 10:33 AM Cadd User: Adam Gutta



Brown AND Caldwell

SCALE: 1" = 100'

149339

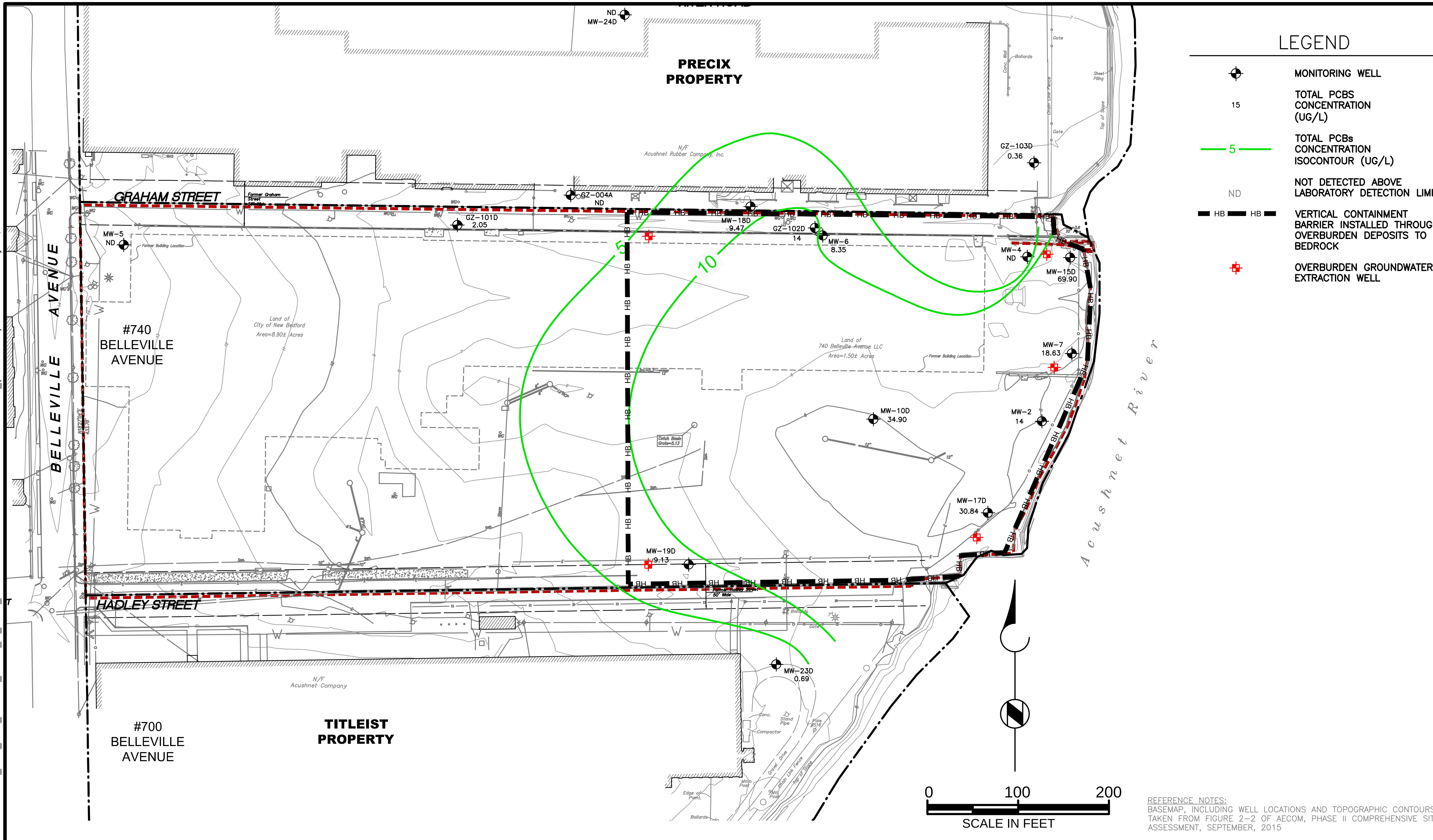
DATE: July 29, 2016

AVX CORPORATION
740 BELLEVILLE AVENUE
NEW BEDFORD, MA

FORMER AEROVOX FACILITY
OU-3B
(OVERBURDEN GROUNDWATER)
ALTERNATIVE 1

FIGURE
4.3.3B-1

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-3B_(FIG 4.3.3B) Plot Date: July 29, 2016 10:28 AM Cadd User: Adam Gutta



Brown AND Caldwell

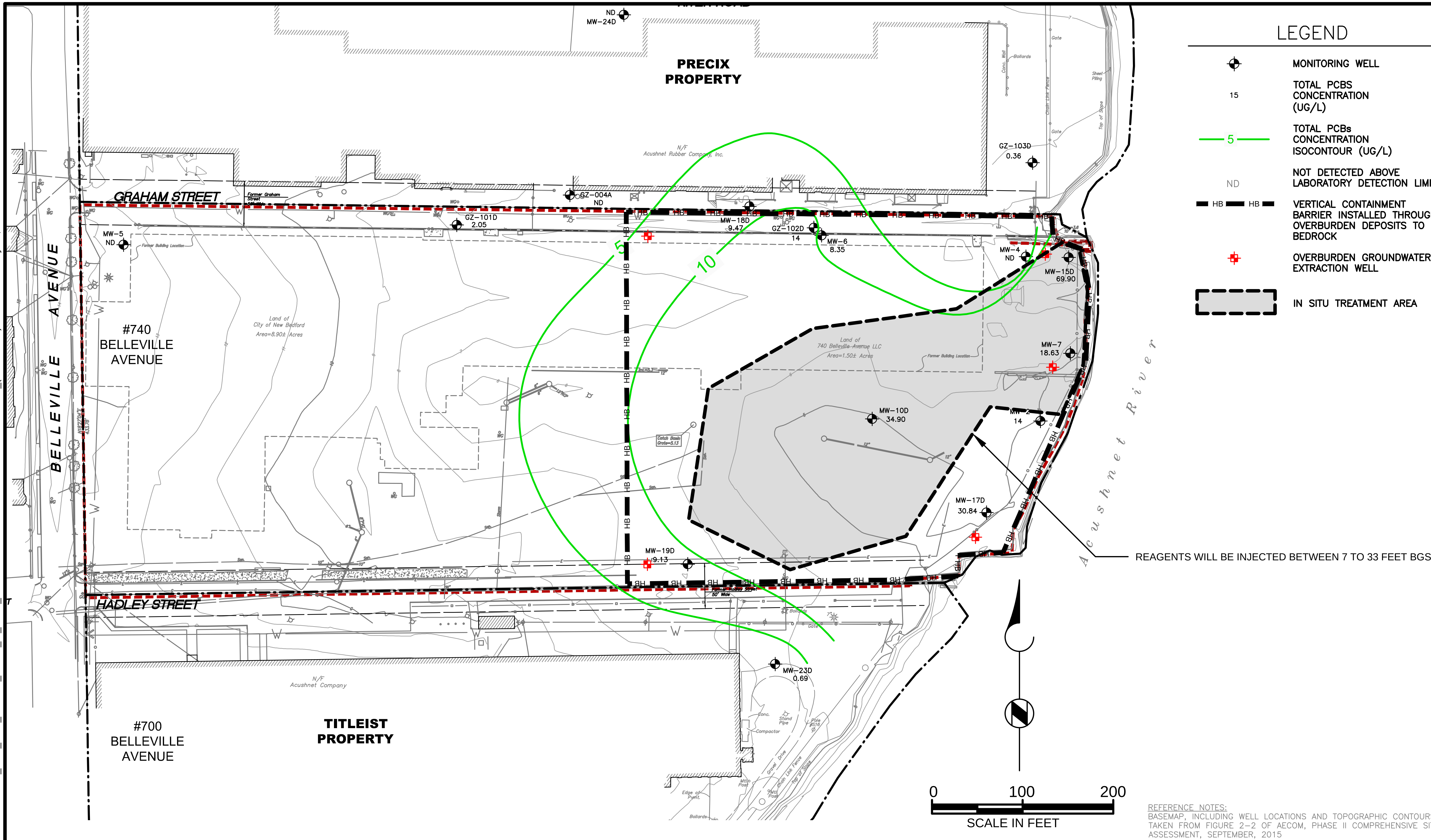
SCALE: 1" = 100'
149339
DATE: July 29, 2016

AVX CORPORATION
740 BELLEVILLE AVENUE
NEW BEDFORD, MA

FORMER AEROVOX FACILITY
OU-3B
(OVERBURDEN GROUNDWATER)
ALTERNATIVE 2

FIGURE
4.3.3B-2

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CADD\2-SHEETS\C-CIVIL File Name: OU-3B_(FIG 4.3.3B) Plot Date: July 29, 2016 10:29 AM Cadd User: Adam Gutta



Brown AND Caldwell

SCALE: 1" = 100'

149339

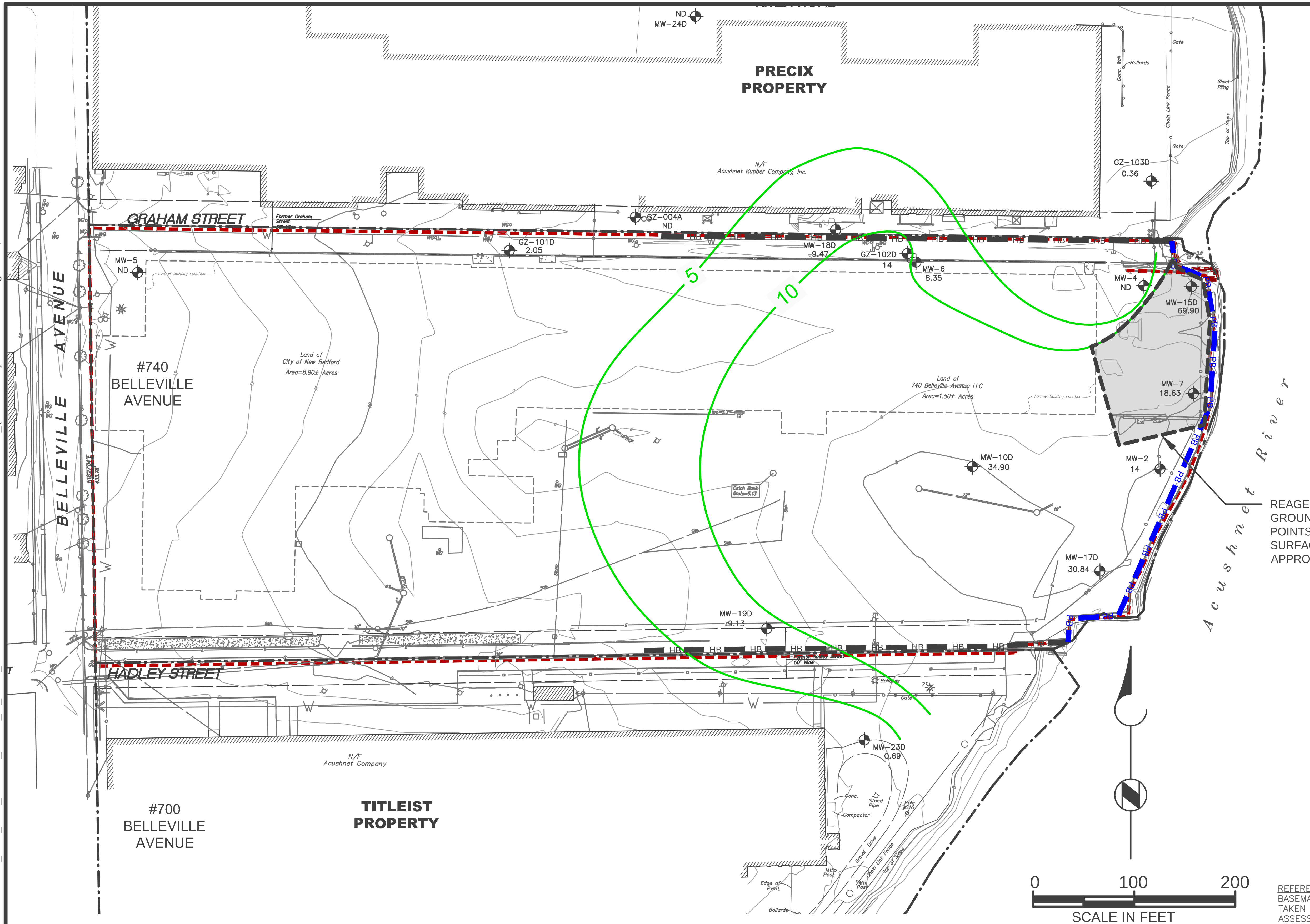
DATE: July 29, 2016

AVX CORPORATION
740 BELLEVILLE AVENUE
NEW BEDFORD, MA

FORMER AEROVOX FACILITY
OU-3B
(OVERBURDEN GROUNDWATER)
ALTERNATIVE 3

FIGURE
4.3.3B-3

Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CADI2-SHEETS\C-CIVIL File Name: OU-3B_(FIG 4.3.3B) Plot Date: July 29, 2016 10:29 AM Cadd User: Adam Gutta



LEGEND

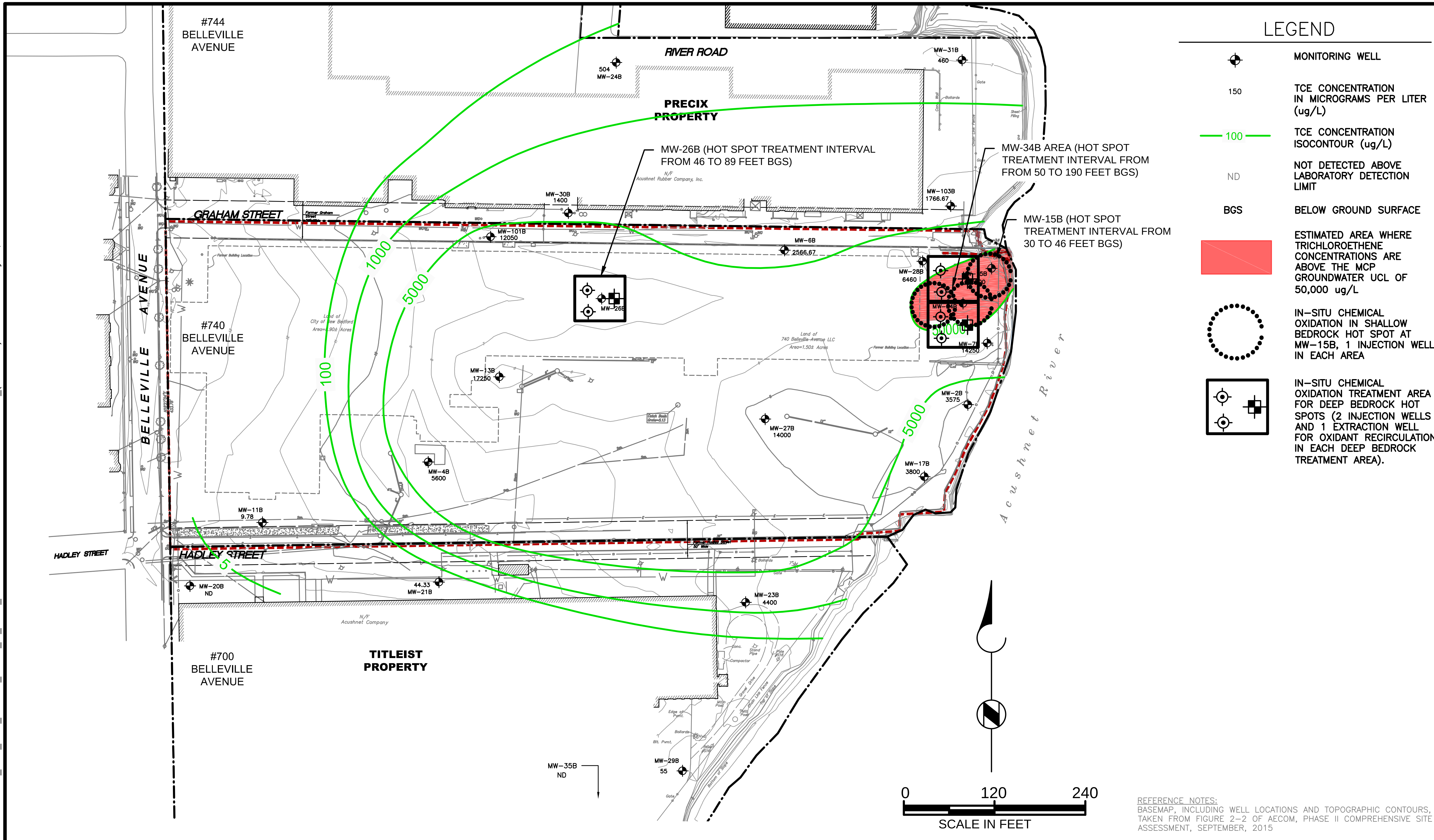
- MONITORING WELL
- 15 — TOTAL PCBS CONCENTRATION (UG/L)
- 5 — TOTAL PCBs CONCENTRATION ISOCONTOUR (UG/L)
- ND — NOT DETECTED ABOVE LABORATORY DETECTION LIMIT
- HB — VERTICAL CONTAINMENT BARRIER INSTALLED THROUGH OVERBURDEN DEPOSITS TO BEDROCK
- PB — PERMEABLE REACTIVE BARRIER INSTALLED THROUGH OVERBURDEN DEPOSITS TO BEDROCK
- IN SITU TREATMENT OF HOT SPOTS

REAGENTS WILL BE DELIVERED TO THE OVERBURDEN GROUNDWATER THROUGH DIRECT PUSH INJECTION POINTS TO A DEPTH FROM 7 TO 33 FEET BELOW GROUND SURFACE. INJECTION POINTS WILL BE SPACED ON APPROXIMATELY 15- TO 30-FOOT CENTERS.

REFERENCE NOTES:
BASEMAP, INCLUDING WELL LOCATIONS AND TOPOGRAPHIC CONTOURS, TAKEN FROM FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER, 2015

Brown AND Caldwell	SCALE: 1" = 100' 149339 DATE: August 22, 2016	AVX CORPORATION 740 BELLEVILLE AVENUE NEW BEDFORD, MA	FORMER AEROVOX FACILITY OU-3B (OVERBURDEN GROUNDWATER) ALTERNATIVE 4	FIGURE 4.3.3B-4

Path: P:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-3B_(FIG 4.3.3B) Plot Date: August 22, 2016 5:26 PM Cadd User: Julie Kotowski



Path: T:\AVX\New_Bedford\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL File Name: OU-4_(FIG 4.3.4) Plot Date: July 29, 2016 10:44 AM Cadd User: Adam Gutta

Brown AND Caldwell

SCALE: 1" = 100'

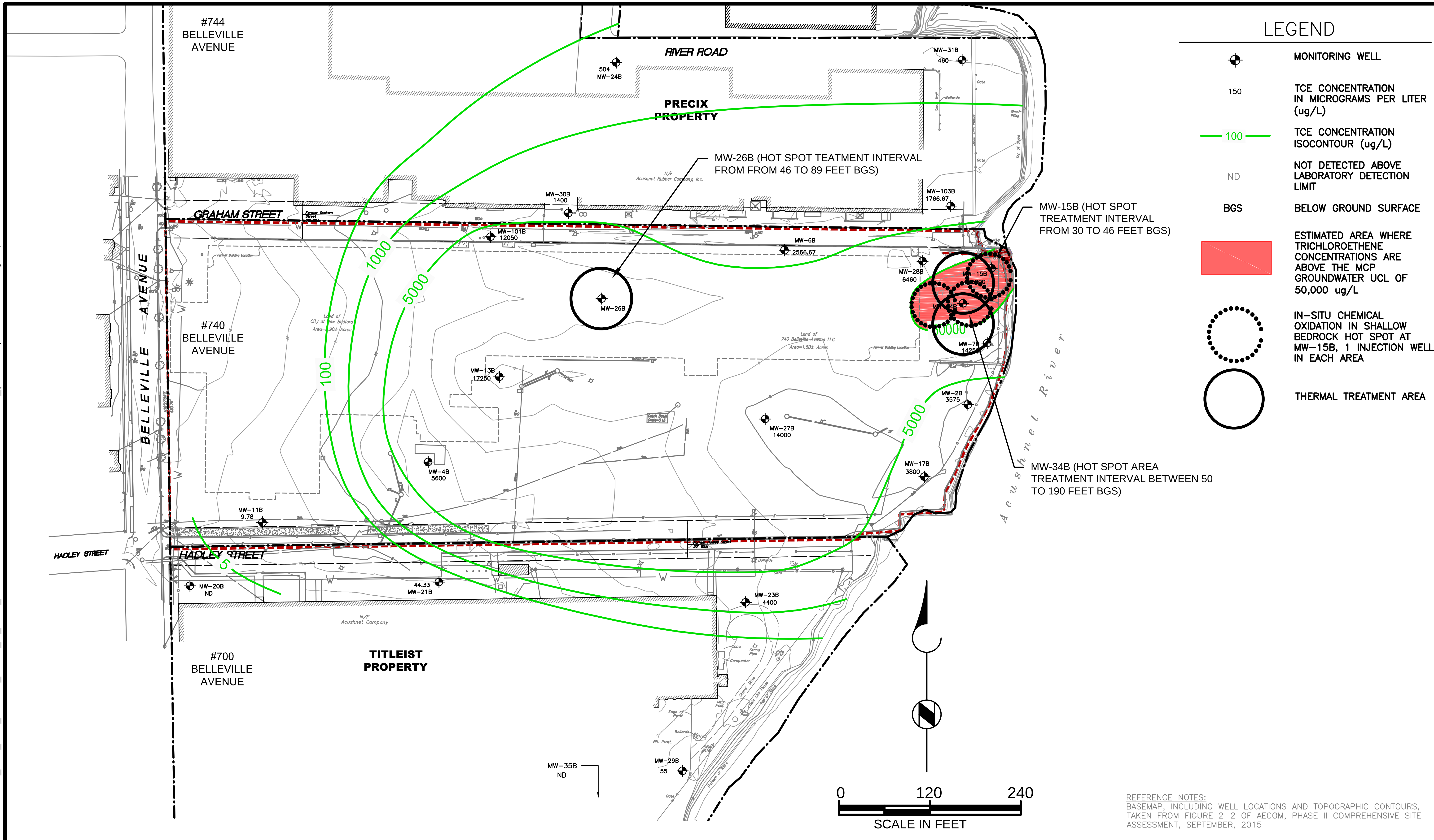
149339

DATE: July 29, 2016

FORMER AEROVOX FACILITY
OU-4
(BEDROCK GROUNDWATER)
ALTERNATIVE 1

FIGURE

4.3.4-1



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Brown AND Caldwell

SCALE: 1" = 100'

149339

DATE: July 29, 2016

FORMER AEROVOX FACILITY
OU-4
(BEDROCK GROUNDWATER)
ALTERNATIVE 2

FIGURE 4.3.4-2

TABLE 4.1
TECHNOLOGY IDENTIFICATION AND SCREENING
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

Media and PRGs	Technology Category	Technology	Advantages	Disadvantages	Feasibility	Status for Alternative Development
SOIL Reduce to the extent feasible or control the concentrations of PCBs and CVOCs in soil such that: a. Potential exposure to surface soil that is not capped will achieve a level of No Significant Risk b. Potential exposure to surface or subsurface soil beneath the Site cap will achieve a condition of No Significant Risk c. Soil is eliminated to the extent feasible or controlled as a source of impacts to groundwater and indoor air d. Soil less than 15 feet below grade surface (bgs) with concentrations above UCL levels is eliminated to the extent feasible or controlled through the use of an engineered barrier.	Treatment	**In-Situ Biological Treatment -** Involves the application of nutrients and microorganisms to the subsurface to enhance the population of microorganisms that use the contaminants as a food source.	Does not depend on off-site disposal Effective for CVOCs	Can't implement in an unsaturated zone Not proven effective for PCBs Delivery/injection system is highly critical for complete distribution of amendments Proximity to river and varying subgrade conditions pose difficulties for uniform amendment distribution Relatively long time frame to achieve mass reduction in COCs	Technology is available, however not likely to achieve the reduction of COCs to desired concentrations due to difficulty in implementing this technology at this site (potential presence of NAPL, proximity to river, varying groundwater elevations, brackish water, temperature, moisture and pH variations, etc.)	Not Retained
		Ex-Situ Biological Treatment Involves the application of nutrients and microorganisms to soils after removal to enhance the population of microorganisms that use the contaminants as a food source.	Does not depend on off-site disposal Better control over process than in-situ application Effective for CVOCs	Not proven effective for PCBs on a full scale basis.	Technology is available and may achieve a permanent solution[1]	Retained for OU-3A
		In-Situ Chemical Treatment - Involves applying reagent(s) to the subsurface to chemically break down the contaminants.	Does not depend on off-site disposal Effective for CVOCs	Requires chemicals to be utilized onsite (handle/manage hazardous materials in riverfront area) Not proven effective for PCBs Limited use in unsaturated zone Delivery/injection system highly critical for complete distribution of amendments	Technology is available, however not likely to achieve the reduction of COCs to desired concentrations due to difficulty in implementing this technology at this site (potential presence of NAPL, proximity to river, varying groundwater elevations, brackish water, temperature, moisture and pH variations, etc.)	Not Retained
		Ex-Situ Chemical Treatment - Involves applying reagent(s) to soils after removal to chemically break down the contaminants.	Does not depend on off-site disposal Better control over process than in-situ application Effective for CVOCs	Requires chemicals to be utilized onsite (handle/manage hazardous materials in riverfront area) Not proven effective for PCBs	Technology is available and may achieve a permanent solution	Retained for OU-3A
		In-Situ Solidification/Stabilization (ISS) - Involves in-situ mixing of soil with solidification/stabilization agents to reduce the mobility of contaminants.	Does not depend on off-site disposal except possibly for excess soils due to expansion Effective for immobilizing PCBs	Swell (excess soil) management required Not cost effective in shallow soils Does not reduce the concentration of PCBs or CVOCs	Technology likely would not achieve a permanent solution	Not retained
		Ex-Situ Soil Washing- Involves desorbing chemicals from fine soil particles in a water based system after soils are removed via the use of water, surfactants, leaching agents or chelating agents or pH adjustment.	Reduces disposal cost after treatment Effective for PCBs	Complicated to implement Would require residual water treatment in addition to soil treatment (added waste stream) Soil disposal required after treatment	Technology is difficult to implement, and not reasonably certain to achieve reductions of COC's to desired concentrations or achieve sufficient separation of impacted fines from less impacted coarser materials.	Not retained
		Air Sparging/SVE – Involves the injection of air or oxygen for stripping and volatilization of constituents from a contaminated aquifer.	Capable of removing TCE from under buildings (using horizontal drilling) Low degree of difficulty to implement Established technology	Tidal influence in subgrade (varying groundwater levels) would complicate design and operations of a system Insufficient unsaturated zone to collect soil vapors Not effective on PCBs	Technology is available, however not likely to achieve the reduction of COCs to desired concentrations due to site conditions (PCBs, proximity to river, varying groundwater elevations, etc.)	Not retained
		Thermal Treatment (Ex Situ) – Involves heating excavated soil using steam, hot air, electrical resistance or conductivity to increase the volatilization rate of contaminants and facilitate extraction and recovery as a vapor.	Effective for CVOCs Can address DNAPL in specific type of bedrock	High energy consumption Higher temperature requirements for PCBs	Technology could be applied ex situ and may achieve a permanent solution	Retained for OU-3A

TABLE 4.1
TECHNOLOGY IDENTIFICATION AND SCREENING
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

Media and PRGs	Technology Category	Technology	Advantages	Disadvantages	Feasibility	Status for Alternative Development
		Thermal Treatment (In Situ) – Involves heating the subsurface using steam, hot air, electrical resistance or conductivity to increase the volatilization rate of contaminants and facilitate extraction and recovery as a vapor.	Effective for CVOCs Can address DNAPL in specific type of bedrock Effective also in groundwater on VOCs with boiling points < water	Not applicable under building (no unsaturated zone to collect soil vapors) In-Situ confounded by infinite supply of water from adjacent harbor without hydraulic control High energy consumption Higher temperature requirements for PCBs	Technology could be applied in situ and may achieve a permanent solution	Not Retained
	Containment	**Cap or Engineered Barrier** - Consists of a physical barrier that prevents contact with the impacted soil and source material.	Handling/excavation of contaminated materials not required Low degree of difficulty to implement.	AUL required Long term maintenance of cap	Technology is available and reasonably likely to achieve a permanent solution	Retained for OU-1 and OU-3A
	Excavation, Disposal	**Excavation and Off-Site Disposal** - Involves excavating soils and source material and disposing of off-site.	Low degree of difficulty to implement. Reduces mass and volume of contaminants remaining on site	Utilizes off-site disposal capacity Implementation risks associated with material handling and transportation Not applicable under building and for deep contamination Additional waste stream (dewatering)	Technology is available and reasonably likely to achieve a permanent solution	Retained for OU-1 and OU-3A
	Excavation, Consolidation	**Excavation and On-Site Consolidation** - Involves excavating soils on-site and on adjacent Titleist property, consolidating contaminated soils in one area of the subsurface on the Aerovox property, and covering the area with an engineered barrier.	Low degree of difficulty to implement. Does not utilize off-site disposal capacity Does not create risks associated with off-site transportation	Not applicable under building and for deep contamination Additional waste stream (dewatering) Long term maintenance of cap Does not reduce mass or volume of contaminants remaining on site	Technology is available and reasonably likely to achieve a permanent solution	Retained for OU-1 and OU-3A
	Activity and Use Limitation	**Legal Document** - Specifies allowable and prohibited use of the property.	Already provided for Aerovox property	Requires agreement of abutting property owners Does not reduce mass, volume or toxicity of contaminants	Reasonably likely to achieve a permanent solution in conjunction with another technology	Retained for OU-1, OU-2 and OU-3A
GROUNDWATER Reduce to the extent feasible or control the concentrations of PCBs and CVOCs in groundwater such that: a. Groundwater is eliminated to the extent feasible or controlled as a source of impacts to indoor air b. Groundwater is eliminated to the extent feasible or controlled as a source of impacts to surface water and sediment c. Plumes of dissolved PCBs and CVOCs in groundwater are stable or contracting d. Concentrations of CVOCs, specifically trichloroethene, in groundwater are reduced to below UCL.	Containment	**Vertical Barriers (Sheet Pile, Slurry Wall, Soil Mix Wall)** – Used to contain, divert, or direct contaminated groundwater	Proven technologies Low degree of difficulty to implement. Effective for overburden	No confining layer to key into Does not reduce mass, volume or toxicity Not effective for bedrock	Technology is available and reasonably likely to achieve a permanent solution in conjunction with another technology	Retained for OU-3B
		Jet-Grouting for top of rock – Involves the injection of a cementitious mixture into the subsurface to fill fractures and voids that transmit contaminated groundwater.	Applicable for shallow bedrock May reduce infiltration up from bedrock	Difficult to implement and may not provide a complete barrier due to site conditions Does not reduce mass, volume or toxicity	Technology is available, however not likely to achieve the reduction of COCs to desired concentrations due to difficulty in implementing this technology at this site (proximity to river, type of bedrock)	Not retained
		Hydraulic Containment and Ex-Situ Treatment – Involves the extraction of groundwater to confine the movement of contaminated groundwater.	Proven technology Low degree of difficulty to implement. Effective for overburden and bedrock	Generates multiple waste streams (groundwater that will require treatment, emissions treatment, etc.) Long term O&M Discharge limits must be met for all GW constituents present (not only site COC's) Proximity to waterbody will likely result in very high extraction rates	Technology is available and reasonably likely to achieve a permanent solution	Retained for OU-3B
	Treatment	**In-Situ Biological Treatment**- Involves the application of nutrients and microorganisms to the subsurface to enhance the population of microorganisms that use the contaminants as a food source.	Enhances existing processes naturally occurring on site Effective for CVOCs	Long term operation Not effective on NAPL Delivery/injection system is highly critical	Technology is available and may achieve a permanent solution	Retained for OU-3B

TABLE 4.1
TECHNOLOGY IDENTIFICATION AND SCREENING
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

Media and PRGs	Technology Category	Technology	Advantages	Disadvantages	Feasibility	Status for Alternative Development
			Reduces the toxicity and volume of COCs (provided that degradation cycle is complete)	for complete distribution of amendments Proximity to river and varying subgrade conditions pose difficulties for uniform amendment distribution Relatively long time frame to achieve mass reduction in COCs		
		In-Situ Chemical Treatment - Involves applying reagent(s) to the subsurface to chemically break down the contaminants.	Effective for CVOCs Potentially addresses or partially addresses NAPL Reduces the toxicity and volume of COCs	Delivery/injection system highly critical for complete distribution of amendments Proximity to river and varying subgrade conditions pose difficulties for uniform amendment distribution Handling and storage of potentially hazardous materials	Technology is available and may achieve a permanent solution	Retained for OU-4
		In-Situ Thermal Treatment – Involves heating the subsurface (In-Situ) or soil (Ex-Situ) using steam, hot air, electrical resistance or conductivity to increase the volatilization rate of contaminants and facilitate extraction and recovery as a vapor.	Demonstrated in specific fractured rock environments Short timeframe to implement Effective also in soil with COCs containing boiling points < water	High energy cost from near infinite source of fresh water	Technology is available and may achieve a permanent solution	Retained for OU-4
		Permeable Reactive Barrier –Involves the installation of reactive materials through which a dissolved contaminant plume moves through its natural migration with treated water exiting the other side.	Effective on CVOCs Works with existing geochemical environment Low O&M effort	Unproven for PCBs Low likelihood of success in bedrock High disposal cost for construction derived waste Additional waste stream(s) Limited lifetime that may require regeneration or replacement in the future	Technology is available and may achieve a permanent solution	Retained for OU-3B
		Monitored Natural Attenuation	Low degree of difficulty to implement. Monitoring network in place	Relatively long time to reach goals Does not address sources (depends on other technology for this)	Technology is available and may achieve a permanent solution	Retained for OU-3B and OU-4
SOIL GAS Reduce to the extent feasible or control the concentrations of CVOCs in sub slab soil gas and/or indoor air on the Precix property such that: a. Potential exposure to indoor air will achieve a level of No Significant Risk	Monitored Attenuation	**Indoor Air Monitoring** and subslab Monitoring- Quarterly, semi-annually, annually, etc.	Low degree of difficulty to implement. Potentially useful during ROS, allows flexibility when permanent solution is reached.	Does not mitigate potential issues/exceedances	Technology is available and may achieve a permanent solution. Indoor air monitoring would provide information to determine if mitigation would be needed in future.	Retained for OU-2
	Vapor Barrier	**Installation of a vapor barrier –** Install over lowest level floor slab (i.e., Retrocoat)	Moderate degree of difficulty to implement. Proven technology Readily available Effective where there is no unsaturated zone (not dependent on collection of vapors)	Disruptive to operations Long term maintenance Limits use of floor slab	Technology is available and would provide for a permanent solution for mitigation of vapor intrusion (does not address source)	Retained for OU-2
	Subslab System	**Passive Subslab** - Installation of passive subslab depressurization system (vent system for subslab with discharge piping to roof)	Low degree of difficulty to implement. Low maintenance	Limited effectiveness (passive system) Not effective in saturated conditions (absence of vadose zone) Not a permanent solution	Technology is available, but has not proven to be reliably effective	Not retained
		Active Subslab - Installation of active subslab depressurization system (vent system for subslab with blower and discharge piping to roof)	Highly effective in reducing subslab concentrations Easily implementable Low maintenance	Not effective in saturated conditions (absence of vadose zone) Requires telemetry Requires AUL May require off-gas treatment	Technology is available and would provide for a permanent solution for mitigation of vapor intrusion (does not address source).	Retained for OU-2

TABLE 4.1
TECHNOLOGY IDENTIFICATION AND SCREENING
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

Media and PRGs	Technology Category	Technology	Advantages	Disadvantages	Feasibility	Status for Alternative Development
NAPL Remove or contain measured Site NAPL with PCBs and/or CVOCs such that: a. Non-stable NAPL is not present under current site conditions and for the foreseeable future b. all NAPL with Micro-scale Mobility is removed to the extent feasible	Excavation	**Excavation and Off-Site Disposal**	Highly effective for overburden Removes NAPL in overburden zone Low degree of difficulty to implement. Proven technology	Utilizes off-site disposal capacity Implementation risks associated with material handling and transport Additional waste stream (dewatering) Not implementable in bedrock and difficult to implement in deep bedrock	Technology is available and reasonably likely to achieve a permanent solution in conjunction with another technology	Retained for OU-3A
	Recovery	**Free Product Recovery and Disposal**	Low degree of difficulty to implement. Proven technology	Only removes NAPL that is mobile (flows into the recovery wells) Time frame can be long to achieve objectives Will not address residual NAPL Potential long term O&M until micro-scale mobility is eliminated to the extent feasible.	Technology is available and reasonably likely to achieve a permanent solution in conjunction with another technology	Retained for OU-3A
Reduce to the extent feasible or control the concentrations of PCBs in soil within the Site storm sewer system such that: a. Migration of PCB impacted soil through the storm sewers is eliminated to the extent feasible or controlled as a source of impacts to surface water.	Remove Storm Sewer	**Remove and Replace Storm Sewer Line**	Effective at removing storm sewer sediments and preventing/reducing migration via infiltration into storm sewer	Generates waste stream Implementation risks associated with material handling and transport Requires periodic inspection and maintenance	Technology is available and reasonably likely to achieve a permanent solution in conjunction with another technology	Retained for OU-3A
	Clean Storm Sewer	**Clean and Line Existing Storm Sewer**	Effective at preventing/reducing migration via infiltration into storm sewer	Requires periodic inspection and maintenance Some sections of existing sewer may be too damaged to support lining.	Technology is available and reasonably likely to achieve a permanent solution in conjunction with another technology	Retained for OU-3A

Notes:

1 When it is stated that the technology may achieve a permanent solution, it is implied that the technology may be capable of achieving a permanent solution by itself or in combination with other technologies and/or controls.

TABLE 4.3.1
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 1 – TITLEIST PROPERTY SOILSPHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

The Aerovox Project Operable Unit 1 (OU1) is comprised of the surface soils above the peat layer within the eastern unpaved landscaped area of the Acushnet/Titleist property. The remedial goals for OU1 are to

1. Eliminate or reduce concentrations, to the extent feasible, or control access to areas with soils with contaminant concentrations > than their respective UCLs (i.e. surface soils with PCB concentrations > 100 mg/kg)
2. Eliminate/reduce, to the extent feasible, or control access to surface soils that present unacceptable risk under current or foreseeable future site use.

PARAMETER	ALTERNATIVE 1 Removal of PCB Impacted Soils in Upper Two Feet (<1 mg/kg) and at Depth (>100 mg.kg)	ALTERNATIVE 2 Removal of PCB Impacted Soils at Concentrations Greater Than Commercial/Industrial Risk Based Concentration (4 mg/kg)	ALTERNATIVE 3 Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)	ALTERNATIVE 4 PCB Impacted Soils Addressed with Asphalt Cap (> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)
Size and Configuration	This alternative includes: excavate and remove soils in top 2' with PCB concentrations > 1 mg/kg and deeper locations with PCB concentrations > 100 mg/kg, install demarcation marker layer and two feet of clean backfill, provide AUL to restrict foreseeable future use of soil below the demarcation marker layer, restore landscaping, dispose of excavated material. Excavation in the footprint area shown on Figure 2-1. Excavation would be conducted to depths of 2 feet below grade surface (bgs) to address soils with PCB concentrations greater than 1 mg/kg and deeper in isolated areas to address soils with PCB concentrations in excess of the UCL. These deeper areas and corresponding depths are also shown on Figure 2-1. Soil excavation would not go below the top of peat layer. This alternative would include the excavation of approximately 6,600 cubic yards of soil. An AUL would be placed on the impacted portion of the property to restrict foreseeable future site uses and provide for maintenance of the soil cap.	This alternative includes: excavate and remove surface soils that are currently above risk based concentration for current site use, backfill with clean fill and restore landscaping, provide AUL to restrict foreseeable future use, dispose of excavated material. This alternative is similar to Alternative 1 with the exception that soils with concentrations of contaminants above the risk based concentrations for the current site usage (commercial/industrial) would be removed and disposed of off-site. The soils to be addressed under this alternative and their respective depths are depicted on Figure 2-2. This alternative would include the excavation of approximately 7,300 cubic yards of soil. An AUL would be placed on the impacted portion of the property to restrict foreseeable future site uses and provide for maintenance of the soil cap	This alternative includes: excavate and remove surface soils that are currently above risk based concentrations for foreseeable future use as residential property, backfill with clean fill and restore landscaping, dispose of excavated material This alternative would include the excavation of approximately 9,400 cubic yards of soil. This alternative is similar to Alternative 2 with the exception that soils with concentrations of contaminants above the risk based concentrations for residential usage would be removed and disposed of off-site. The soils to be addressed under this alternative and their respective depths are depicted on Figure 2-3. As the soils would be removed to allow for a future residential site usage, no AUL is necessary.	This alternative includes: install a demarcation layer and pavement cap over soils with PCB concentrations > 1 mg/kg and an engineered barrier at locations with PCB concentrations > 100 mg/kg, provide AUL to restrict foreseeable future use and provide for cap maintenance, dispose of soil, if any, that needs to be removed to construct the Engineered Barrier. The pavement cap with a minimum asphalt thickness of 3 inches will be installed over the footprint area shown on Figure 2-4. In areas where soils are present at concentrations in excess of their respective UCL, install a cap that meets the requirements for an Engineered Barrier as defined in the MCP. These Engineered Barrier areas are also shown on Figure 2-4. This alternative would include the excavation of soil only if needed to accommodate the placement of the Engineered Barrier. An AUL would be placed on the impacted portion of the property to restrict foreseeable future site uses and provide for maintenance of the asphalt cap and Engineered Barrier
Remediation Time	This remedial alternative is estimated to take approximately three months to complete.	This remedial alternative is estimated to take approximately three months to complete.	This remedial alternative is estimated to take approximately three months to complete.	This remedial alternative is estimated to take approximately one month to complete.
Spatial Requirements	Remedial activities could be conducted within the confines of the Site. Excavated soils may be direct loaded for disposal or securely staged within the Aerovox property as needed.	Remedial activities could be conducted within the confines of the Site. Excavated soils may be direct loaded for disposal or securely staged within the Aerovox property as needed.	Remedial activities could be conducted within the confines of the Site. Excavated soils may be direct loaded for disposal or securely staged within the Aerovox property as needed.	Remedial activities could be conducted within the confines of the Site. Excavated soils may be direct loaded for disposal or securely staged within the Aerovox property as needed.

TABLE 4.3.1
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 1 – TITLEIST PROPERTY SOILSPHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

PARAMETER	ALTERNATIVE 1 Removal of PCB Impacted Soils in Upper Two Feet (<1 mg/kg) and at Depth (>100 mg.kg)	ALTERNATIVE 2 Removal of PCB Impacted Soils at Concentrations Greater Than Commercial/Industrial Risk Based Concentration (4 mg/kg)	ALTERNATIVE 3 Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)	ALTERNATIVE 4 PCB Impacted Soils Addressed with Asphalt Cap (> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)
Disposal Options	Excavated soils would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste. Water generated from dewatering would be treated on-site and discharged either to the river and/ or the local POTW or transported off site for treatment and disposal.	Excavated soils would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste. Water generated from dewatering would be treated on-site and discharged either to the river and/or the local POTW or transported off site for treatment and disposal.	Excavated soils would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste. Water generated from dewatering would be treated on-site and discharged either to the river or the local POTW or transported off site for treatment and disposal.	Excavated soils would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste.
Substantive Permit Requirements	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Additional TSCA risk based approval under 40 CFR 761.61(c) may be required for work inconsistent with the existing TSCA determination for the project. Onsite soil treatment prior to disposal may require approval from EPA depending on the process (40 CFR 761.61). Decontamination in accordance with 40 CFR 761.79 does not require EPA approval. Discharge of groundwater to surface water or to the local POTW may require permitting and/or approvals. If 1 or more acres of land are disturbed, an EPA Construction General Permit for Stormwater and CSWPPP will be required.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Additional TSCA risk based approval under 40 CFR 761.61(c) may be required for work inconsistent with the existing TSCA determination for the project. Onsite soil treatment prior to disposal may require approval from EPA depending on the process (40 CFR 761.61). Decontamination in accordance with 40 CFR 761.79 does not require EPA approval. Discharge of groundwater to surface water or to the local POTW may require permitting and/or approvals. If 1 or more acres of land are disturbed, an EPA Construction General Permit for Stormwater and CSWPPP will be required.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Additional TSCA risk based approval under 40 CFR 761.61(c) may be required for work inconsistent with the existing TSCA determination for the project. Onsite soil treatment prior to disposal may require approval from EPA depending on the process (40 CFR 761.61). Decontamination in accordance with 40 CFR 761.79 does not require EPA approval. Discharge of groundwater to surface water or to the local POTW may require permitting and/or approvals. If 1 or more acres of land are disturbed, an EPA Construction General Permit for Stormwater and CSWPPP will be required.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. If 1 or more acres of land is disturbed, an EPA Construction General Permit for Stormwater and CSWPPP will be required.

TABLE 4.3.1
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 1 – TITLEIST PROPERTY SOILSPHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

PARAMETER	ALTERNATIVE 1 Removal of PCB Impacted Soils in Upper Two Feet (<1 mg/kg) and at Depth (>100 mg.kg)	ALTERNATIVE 2 Removal of PCB Impacted Soils at Concentrations Greater Than Commercial/Industrial Risk Based Concentration (4 mg/kg)	ALTERNATIVE 3 Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)	ALTERNATIVE 4 PCB Impacted Soils Addressed with Asphalt Cap (> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)
Substantive Permit Requirements (cont.)	310 CMR 30.305(5): Generators of hazardous wastes which contain PCBs in concentrations equal to or greater than 50 parts per million shall send such wastes only to facilities which meet all the requirements in 310 CMR 30.501(3)(a) through (c), or shall, with the **approval of the Department**, otherwise cause such hazardous wastes to be managed in compliance with the provisions of 40 CFR Part 761 and 310 CMR 30.750 (Land Disposal Restrictions).	310 CMR 30.305(5): Generators of hazardous wastes which contain PCBs in concentrations equal to or greater than 50 parts per million shall send such wastes only to facilities which meet all the requirements in 310 CMR 30.501(3)(a) through (c), or shall, with the **approval of the Department**, otherwise cause such hazardous wastes to be managed in compliance with the provisions of 40 CFR Part 761 and 310 CMR 30.750 (Land Disposal Restrictions).	310 CMR 30.305(5): Generators of hazardous wastes which contain PCBs in concentrations equal to or greater than 50 parts per million shall send such wastes only to facilities which meet all the requirements in 310 CMR 30.501(3)(a) through (c), or shall, with the **approval of the Department**, otherwise cause such hazardous wastes to be managed in compliance with the provisions of 40 CFR Part 761 and 310 CMR 30.750 (Land Disposal Restrictions).	

Notes:
1. *Area and volumes presented in the table are estimates.*
2. *The conceptual plans for Alternatives 1 through 4 are presented as Figures 2-1 through 2-4.*

TABLE 4.3.2
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 2 – PRECIX PROPERTY VAPOR INTRUSION
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

The Aerovox Project Operable Unit 2 (OU2) is comprised of the subsurface soil and shallow overburden groundwater (GW) on the Precix property that may contribute to future risk resulting from a complete vapor intrusion pathway. The remedial goals for OU2 are to:

1. Reduce CVOC GW and subslab soil gas concentrations, to extent feasible and control these media as potential sources for vapor intrusion in GW2 areas.
2. Mitigate or control subsurface migration of CVOCs and vapor intrusion to occupied buildings in GW2 areas so that indoor air concentrations do not exceed risk based levels for foreseeable future use.

PARAMETER	ALTERNATIVE 1 Monitored Subslab Soil Gas Attenuation	ALTERNATIVE 2 Vapor Barrier Over Floor Slab	ALTERNATIVE 3 Active Subslab Depressurization System
Size and Configuration	This alternative includes: monitor subslab gas attenuation to confirm vapor intrusion does not present a significant risk for current or foreseeable future building occupants, and provide AUL to restrict building use until attenuation demonstrates vapor intrusion related restrictions are no longer required. Provide monitoring of groundwater, subslab soil gas and indoor air within the area of the Precix property where GW2 applies and groundwater levels are above corresponding GW2 values. This area is shown on Figure 3-1. An AUL would be placed on the impacted portion of the property to restrict foreseeable future building uses to those activities and uses that would result in no greater exposure of occupants to indoor air than current use.	This alternative includes: install a vapor barrier over the floor slab, including floor penetrations, to restrict future vapor infiltration. Provide seasonal monitoring of subslab soil gas and indoor air within the area of the Precix property where groundwater contaminant concentrations are above corresponding GW2 values to demonstrate continued effectiveness of the barrier. This area is shown on Figure 3-2. An AUL would be placed on the impacted portion of the property to restrict foreseeable future building uses to those activities and uses that would result in no greater exposure of occupants to indoor air than current use and to provide for continued monitoring, inspection and maintenance of the vapor barrier.	This alternative includes: install an active subslab depressurization system (Active Exposure Pathway Mitigation Measure or AEPMM) within the area of the Precix property where GW2 applies and groundwater contaminant concentrations are above corresponding GW2 values. This area is shown on Figure 3-3. An AUL would be placed on the impacted portion of the property to restrict foreseeable future building uses and provide for continued operation and maintenance of the AEPMM. Remote telemetry would be required as part of the AEPMM
Remediation Time	Monitoring would remain in effect for approximately 30 years or until attenuation demonstrates vapor intrusion related restrictions are no longer required.	Monitoring of subslab and indoor air and inspection and maintenance of the vapor barrier would remain in effect for approximately 30 years or until attenuation demonstrates vapor intrusion related restrictions are no longer required.	Operation and maintenance of the subslab depressurization system would remain in effect for approximately 30 years or until attenuation demonstrates vapor intrusion related restrictions are no longer required.
Spatial Requirements	Remedial activities could be conducted within the confines of the Site.	Remedial activities could be conducted within the confines of the Site.	Remedial activities could be conducted within the confines of the Site.
Disposal Options	No remediation derived wastes would be generated during implementation of this remedial alternative.	No remediation derived wastes would be generated during implementation of this remedial alternative.	Off gas treatment, if required, may result in off-site transportation and disposal of treatment derived waste (e.g. vapor phase carbon).
Substantive Permit Requirements	No permits are necessary to be obtained for implementation of this remedial alternative.	No permits are necessary to be obtained for implementation of this remedial alternative.	No permits are necessary to be obtained for implementation of this remedial alternative.

Notes:
1. Area and volumes presented in the table are estimates.
2. The conceptual plans for Alternatives 1 through 3 are presented as Figures 3-1 through 3-3.

TABLE 4.3.3
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

The Aerovox Project Operable Unit 3 (OU3) is the source control OU and is comprised of the Aerovox Property soil, storm sewers and overburden groundwater. For simplicity in evaluating the remedial action components for OU3, the alternatives have been subdivided into (A) soil and (B) groundwater components. The remedial goals for this OU3 are to:

1. Eliminate or reduce concentrations, to the extent feasible, or control access to areas with soils containing contaminants at concentrations greater than their respective UCLs.
2. Eliminate or reduce, to the extent feasible, or control access to soils that present unacceptable risk to human health and/or the environment.
3. Eliminate or reduce, to the extent feasible, or control soil as a potential source of impacts to overburden GW.
4. Reduce concentrations, to the extent practicable, and control migration of overburden GW impacted by PCBs and/or CVOCs at concentrations that could migrate into and present a risk to receptors in surface water and sediment after New Bedford Harbor remediation is complete.
5. Eliminate, to the extent feasible, and control DNAPL in overburden that may be a source of impacts to overburden GW or that may be non-stable.
6. Eliminate, to the extent practicable, and control the migration of PCB impacted sediments in the Site stormwater system.

PARAMETER	ALTERNATIVE A1 Removal and Off-Site Disposal of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE A2 Ex-Situ Treatment of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE A3 Asphalt Cap over Soils With PCB Concentrations > 2 mg/kg and Engineered Barrier Over Soils with Concentrations Above UCLs
Size and Configuration	This alternative includes: excavate and off-site dispose of soils with concentrations above UCLs, backfill with clean fill and restore asphalt cap in areas where needed, clean and line to the extent practicable or replace sections of storm sewer that serve as a preferential migration pathway, finalize the AUL to restrict current and foreseeable future use and provide for long term operation and maintenance of the cap. Excavation would occur in the footprint area shown on Figure 4-1A. Excavation would be undertaken to depths up to 15 feet bgs across areas where soils are impacted by contaminants at concentrations in excess of their respective UCLs. These areas and corresponding depths are also shown on Figure 4-1A. Soil excavation would be required above and below the peat layer and beneath portions of the former building slab. Soils would be segregated based on concentration with those containing contaminant concentrations below their respective UCLs returned to the excavation. This alternative would include the excavation of approximately 26,000 cubic yards of soil. The excavated areas would be backfilled with clean soil (after excavated soils with concentrations below UCLs have been redeposited). Soils with contaminants at concentrations above their respective UCLs would be disposal of off-site. The asphalt cap would be restored where residual PCB contamination at any depth exceeds 2 mg/kg. Existing storm sewers would be repaired, cleaned and lined wherever possible, or sections replaced or reconfigured, as needed. The AUL for the Aerovox property would be finalized to restrict foreseeable future site uses and provide for maintenance of the cap.	This alternative includes: excavate and ex-situ treat soils with contaminant concentrations above UCLs, return soils to subsurface, and restore asphalt cap in areas where needed, clean and line, to the extent practicable, or replace sections of storm sewer that serve as a preferential migration pathway, finalize the AUL to restrict current and foreseeable future use and provide for long term operation and maintenance of the cap. Excavation would occur in the footprint area shown on Figure 4-2A. Excavation would be undertaken to depths up to 15 feet below grade surface (bgs) across areas where soils are impacted by contaminants at concentrations in excess of their respective UCLs. These areas and corresponding depths are also shown on Figure 4-2A. Soil excavation would be required above and below the peat layer and beneath portions of the former building slab. Soils would be segregated based on concentrations with those containing contaminant concentrations below their respective UCLs returned to the excavation without treatment. Soils with concentrations above UCL levels would be treated on site using one of the following treatment process options: biological, chemical, thermal. Final selection of the treatment process would be based on the results of bench or pilot scale testing conducted during Phase IV. This alternative would include the excavation of approximately 26,000 cubic yards of soil. The excavated areas would be backfilled with either soils with contaminants concentrations below their respective UCLs, treated soil or clean imported backfill, as needed. The asphalt cap would be restored where residual PCB contamination at any depth exceeds 2 mg/kg. Existing storm sewers would be repaired, cleaned and lined wherever possible, or sections replaced or reconfigured, as needed. The AUL for the Aerovox property would be finalized to restrict foreseeable future site uses and provide for maintenance of the cap.	This alternative includes: install or maintain the existing pavement asphalt cap over soils with PCB concentrations > 2 mg/kg, install an Engineered Barrier at locations with soil concentrations above UCLs, clean and line to the extent practicable or replace sections of storm sewer that may serve as a preferential migration pathway, finalize the AUL to restrict current and foreseeable future use and provide for long term operation and maintenance of the cap. The asphalt cap with a minimum asphalt thickness of 3 inches will extend over the footprint area shown on Figure 4-3A. In areas where soils within 15 feet of the ground surface are present at concentrations in excess of their respective UCL, the cap shall meet the requirements for an Engineered Barrier as defined in the MCP. Soils excavated for the installation of the Engineered Barrier would be consolidated in other areas of the subsurface under the Site and covered with an appropriate barrier. The anticipated areas to be covered with the Engineered Barrier are also shown on Figure 4-3A. Existing storm sewers would be repaired, cleaned and lined wherever possible, sections replaced or reconfigured, as needed. The AUL for the Aerovox property would be finalized to restrict foreseeable future site uses and provide for maintenance of the cap and Engineered Barrier.

TABLE 4.3.3
DESCRIPTION OF REMEDIAL ALTERNATIVES – OU3
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

PARAMETER	ALTERNATIVE A1 Removal and Off-Site Disposal of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE A2 Ex-Situ Treatment of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE A3 Asphalt Cap over Soils With PCB Concentrations > 2 mg/kg and Engineered Barrier Over Soils with Concentrations Above UCLs
Remediation Time	Soil excavation would take approximately ten months.	Soil excavation and treatment would take approximately twenty-four months.	Cap and Engineered Barrier installation would take approximately four months.
Spatial Requirements	Remedial activities could be conducted within the confines of the Site. Excavated soils may be direct loaded for disposal or securely staged within the Aerovox property as needed.	Remedial activities could be conducted within the confines of the Site. Soil treatment activities could be conducted within the confines of the Site. Excavated soils that require off-site disposal may be direct loaded or securely staged within the Aerovox property as needed.	Remedial activities could be conducted within the confines of the Site.
Disposal Options	Excavated soils would be transported and disposed off-site at an approved facility. Water generated from dewatering would be treated on-site and discharged to the river and/or the local POTW. In the event that sections of the storm sewer require jetting/cleaning or replacement, remove materials or sections of the original storm sewer system may require offsite disposal if they cannot be consolidated onsite.	Water generated from dewatering would be treated on-site and discharged to the river and/or the local POTW. In the event that sections of the storm sewer require jetting/cleaning or replacement, remove materials or sections of the original storm sewer system may require offsite disposal if they cannot be consolidated onsite.	In the event that sections of the storm sewer require jetting/cleaning or replacement, remove materials or sections of the original storm sewer system may require offsite disposal if they cannot be consolidated onsite.
Substantive Permit Requirements	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Water generated from dewatering and possible storm sewer jetting would be treated on-site and discharged to the river and/ or the local POTW or transported off site for treatment and disposal. If 1 or more acres of land are disturbed, an EPA Construction General Permit for Stormwater and CSWPPP will be required.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Water generated from dewatering and storm sewer jetting would be treated on-site and discharged either to the river and/ or the local POTW or transported off site for treatment and disposal. Onsite soil treatment prior to disposal may require approval from EPA depending on the process (40 CFR 761.61). Decontamination in accordance with 40 CFR 761.79 does not require EPA approval. 310 CMR 30.305(5): Generators of hazardous wastes which contain PCBs in concentrations equal to or greater than 50 parts per million shall send such wastes only to facilities which meet all the requirements in 310 CMR 30.501(3)(a) through (c), or shall, with the **approval of the Department**, otherwise cause such hazardous wastes to be managed in compliance with the provisions of 40 CFR Part 761 and 310 CMR 30.750 (Land Disposal Restrictions). If 1 or more acres of land is disturbed, an EPA Construction General Permit for Stormwater and CSWPPP will be required.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. If 1 or more acres of land is disturbed, an EPA Construction General Permit for Stormwater and CSWPPP will be required.

Notes:
1. Area and volumes presented in the table are estimates.
2. The conceptual plans for Alternatives A1 through A3 are presented as Figures 4-1A through 4-3A.

TABLE 4.3.3
DESCRIPTION OF REMEDIAL ALTERNATIVES – OU3
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

The Aerovox Project Operable Unit 3 (OU3) is the source control OU and is comprised of the Aerovox Property soil, storm sewers and overburden groundwater. For simplicity in evaluating the remedial action components for OU3, the alternatives have been subdivided into (A) soil and (B) groundwater components. The remedial goals for this OU3 are to:

1. Eliminate or reduce concentrations, to the extent feasible, or control access to areas with soils containing contaminants at concentrations greater than their respective UCLs.
2. Eliminate or reduce, to the extent feasible, or control access to soils that present unacceptable risk to human health and/or the environment.
3. Eliminate or reduce, to the extent feasible, or control soil as a potential source of impacts to overburden GW.
4. Reduce concentrations, to the extent practicable, and control migration of overburden GW impacted by PCBs and/or CVOCs at concentrations that could present a risk to receptors in surface water and sediment after New Bedford Harbor remediation is complete, and achieve a stable or contracting groundwater plume.
5. Eliminate, to the extent feasible, and control DNAPL in overburden that may be a source of impacts to overburden GW or that may be non-stable, to the extent such DNAPL control is necessary after completion of the DNAPL IRA
6. Eliminate, to the extent practicable, and control the migration of PCB impacted sediments in the Site stormwater system.

PARAMETER	Alternative B1 Containment Via Vertical Barrier Wall	ALTERNATIVE B2 Containment via Vertical Barrier Wall and Hydraulic Containment	ALTERNATIVE B3 Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination	ALTERNATIVE B4 Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In-Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater Contamination
Size and Configuration	This Alternative includes installing a vertical containment barrier to prevent lateral migration of CVOCs and PCBs outside the containment area. Vertical barrier installation would occur along the alignment shown on Figure 4-4B. The type of barrier would be selected from among effective process options including: slurry wall, in situ mixed wall, sealed sheet piling. Vertical barrier would be installed through the overburden deposits down to bedrock. A monitoring program would be included to provide sentinel monitoring outside the barrier to confirm mitigation of mass flux from the property to the Acushnet River.	This Alternative contains the same remedial components as Alternative B1 with the inclusion of groundwater extraction and treatment to prevent lateral or vertical migration of CVOCs and PCBs outside the containment area and to reduce concentrations of CVOCs and PCBs within the containment area. Groundwater would be hydraulically contained by pumping (with above ground treatment) from a series of extraction wells within the containment area as shown on Figure 4-5B. A monitoring program would be included to confirm containment and provide sentinel monitoring outside the area to confirm mitigation of mass flux from the property to the Acushnet River.	This alternative contains the same remedial components as Alternative B2 with the inclusion of in situ treatment of soils containing concentrations of PCBs and CVOCs acting as a source to overburden groundwater contamination. In situ treatment would be performed by injecting nutrients, organic carbon, microbes, and zero valent iron (Figure 4-6B). A monitoring program would be included to evaluate the success of the groundwater treatment within the hydraulically contained area, confirm containment, and provide sentinel monitoring outside the barrier to confirm mitigation of mass flux from the property to the Acushnet River.	This alternative includes installing a permeable reactive barrier to treat CVOCs and PCBs in overburden groundwater along the downgradient side of the property, with a vertical containment barrier on the northern and southern sides of the impacted area. The two types of barriers would be along the alignment shown on Figure 4-7B). The permeable reactive barrier would be installed though the overburden deposits down to bedrock to treat overburden groundwater. This alternative also includes in situ treatment of soil hot spots acting as a source to overburden groundwater contamination. In situ treatment would be performed by injecting nutrients, organic carbon, microbes, and zero valent iron in the area shown on Figure 4-7B.vA monitoring program would be included to provide sentinel monitoring outside the barrier and to confirm mitigation of mass flux from the property to the Acushnet River.
Remediation Time	Installation of vertical containment barrier would take approximately three months.	Installation of vertical containment barrier, groundwater extraction wells and above ground treatment system would take approximately five months.	Installation of vertical containment barrier, groundwater extraction wells and above ground treatment system, and in-situ treatment system would take approximately six months.	Installation of containment and permeable reactive barrier and in situ treatment system would take approximately four months.
Spatial Requirements	Remedial activities could be conducted within the	Remedial activities could be conducted within the	Remedial activities could be conducted within the confines	Remedial activities could be conducted within the

TABLE 4.3.3
DESCRIPTION OF REMEDIAL ALTERNATIVES – OU3
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

PARAMETER	Alternative B1 Containment Via Vertical Barrier Wall	ALTERNATIVE B2 Containment via Vertical Barrier Wall and Hydraulic Containment	ALTERNATIVE B3 Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination	ALTERNATIVE B4 Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In-Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater Contamination
	confines of the Site. Excavated soils (if any) may be direct loaded for disposal or securely staged within the Aerovox property as needed.	confines of the Site. Excavated soils (if any) may be direct loaded for disposal or securely staged within the Aerovox property as needed.	of the Site. Excavated soils (if any) may be direct loaded for disposal or securely staged within the Aerovox property as needed.	confines of the Site. Excavated soils (if any) may be direct loaded for disposal or securely staged within the Aerovox property as needed.
Disposal Options	Excavated soils (if any) would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste.	Excavated soils (if any) would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste. Extracted groundwater would be treated on site and discharged to the river or to the local POTW.	Excavated soils (if any) would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste. Extracted groundwater would be treated on site and discharged to the river or to the local POTW.	Excavated soils (if any) would either be (a) consolidated on the Aerovox property with other similar soils for subsequent capping or (b) disposed of at an approved facility. Treatment may be performed prior to disposal to render soil a non-TSCA waste.
Substantive Permit Requirements	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Discharge of groundwater to surface water or to the local POTW will require permitting and/or approvals	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Discharge of groundwater to surface water or to the local POTW will require permitting and/or approvals Will require prior DEP approval for addition of Remedial Additives (if any) within 50 feet of the Acushnet River.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Will require prior DEP approval for addition of Remedial Additives (if any) within 50 feet of the Acushnet River.

Notes:
1. Timeframes, area and volumes presented in the table are estimates.
2. The conceptual plans for Alternatives B1 through B4 are presented as Figures 4-4B through 4-7B.

TABLE 4.3.4
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 4 – SITE-WIDE BEDROCK GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

The Aerovox Project Operable Unit 4 (OU4) is comprised of remedial alternatives to address the shallow and deep bedrock groundwater at the Site. The remedial goals for OU4 are to:

1. Reduce concentrations CVOCs and PCBs in fractured bedrock where they exceed their corresponding UCLs, and achieve a stable or contracting plume.
2. Eliminate, to the extent feasible, and control migration of DNAPL in fractured bedrock that may be a source of impacts to GW or that may be non-stable.
3. Reduce concentrations of CVOCs and PCBs, to the extent practicable.

PARAMETER	ALTERNATIVE 1 In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation	ALTERNATIVE 2 In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots and Monitored Natural Attenuation
Size and Configuration	DNAPL and UCL exceedances in fractured bedrock would be treated on site using in-situ chemical oxidation. This alternative involves the injection of reagent(s) into the subsurface to chemically break down DNAPL and contaminants in groundwater at concentrations in excess of their UCLs. The injections would be used in combination with extraction wells to provide circulation of the reagents through the treatment zone in deep bedrock; recirculation not required for shallow bedrock. The selected treatment process would be used to remove source area hotspots. A groundwater monitoring program would be implemented to monitor natural attenuation after treatment and demonstrate a stable or shrinking groundwater plume.	DNAPL and UCL exceedances in deep fractured bedrock would be treated on site using thermal treatment. DNAPL and UCL exceedances in shallow fractured bedrock would be treated on site using chemical oxidation. The thermal treatment component involves heating the fractured rock and groundwater (using heating element installed in borings and steam injection wells) to volatilize contaminants in groundwater (with multi-phase extraction wells) at concentrations in excess of their respective UCLs. The extracted groundwater and vapors would be treated above ground. The chemical treatment component involves oxidizing the contaminants in groundwater. These two components would be used to remove source area hotspots. A groundwater monitoring program would be implemented to monitor natural attenuation after treatment and demonstrate a stable or shrinking groundwater plume.
Remediation Time	Operation of this remedy will extend approximately three to four years	Operation of this remedy will extend approximately two to three years
Spatial Requirements	Remedial activities could be conducted within the confines of the Site.	Remedial activities could be conducted within the confines of the Site.
Disposal Options	No remediation derived waste would be generated under this remedial alternative.	Spent liquid and vapor phase carbon would be generated under this remedial alternative.
Substantive Permit Requirements	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Will require prior DEP approval for addition of Remedial Additives (if any) within 50 feet of the Acushnet River.	Work in the Riverfront Area and Buffer Zone may require permitting under the Wetlands Protection act and local ordinances. Work within 25 feet of the River will need to be designed to support the City of New Bedford's planned Riverwalk. Discharge of groundwater to surface water or to the local POTW will require permitting and/or approvals Will require prior DEP approval for addition of oxidation reagents within 50 feet of the Acushnet River.

<u>*Notes:*</u>
1. *Timeframes, area and volumes presented in the table are estimates.*
2. *The conceptual plans for Alternatives 1 and 2 are presented as Figures5-1 and 5-2.*

TABLE 5.1
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 1 – TITLEIST PROPERTY SOILS
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES			
	ALTERNATIVE OU1-1 Removal of PCB Impacted Soils in Upper Two Feet (<1 mg/kg) and at Depth (>100 mg.kg)	ALTERNATIVE OU1-2 Removal of PCB Impacted Soils at Concentrations Greater Than Commercial/Industrial Risk Based Concentration (4 mg/kg)	ALTERNATIVE OU1-3 Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)	ALTERNATIVE OU1-4 PCB Impacted Soils Addressed with Asphalt Cap (> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)
1. Effectiveness				
a) Achieving a Permanent or Temporary Solution	• Will achieve a Permanent Solution in a reasonable timeframe with site AUL	• Will achieve a Permanent Solution in a reasonable timeframe with site AUL	• Will achieve a Permanent Solution in a reasonable timeframe without an AUL	• Will achieve a Permanent Solution in a reasonable timeframe with site AUL
b) Reuse, Recycling, Destroying, Detoxifying or Treating Oil, and Hazardous Material	• Alternative does not reuse, recycle, destroy, detoxify, or treat OHM	• Alternative does not reuse, recycle, destroy, detoxify, or treat OHM	• Alternative does not reuse, recycle, destroy, detoxify, or treat OHM	• Alternative does not reuse, recycle, destroy, detoxify, or treat OHM
c) Achieving or Approaching Background Concentrations	• Will not approach background in soil after remedial actions are complete	• Will not approach background in soil after remedial actions are complete	• Will approach background concentrations in soil after remedial actions are complete	• Will not approach background in soil after remedial actions are complete • Leaves greater contaminant mass in subsurface than other alternatives.
Effectiveness Rating	Good	Good	Very Good	Fair
Effectiveness Score	3	3	4	2
2. Reliability				
a) Certainty of Success	• Highly successful due to removal of soils above UCL provided a AUL is established and remedial cap is maintained	• Highly successful due to removal of soils above 4 mg/kg provided a AUL is established	• Highly successful due to removal of soils above 1 mg/kg	• Probable success due to installation of asphalt cap and Engineered Barrier provided a AUL is established and remedial cap is maintained
b) Effectiveness of Measures to Manage Residues or Control Emissions/Discharges	• Effectiveness is dependent on AUL compliance	• Effectiveness is dependent on AUL compliance	• Management of residuals not required	• Effectiveness is dependent on AUL compliance
Reliability Rating	Good	Good	Very Good	Good
Reliability Score	3	3	4	3
3. Implementability				
a) Technical Complexity	• Low to moderate technical complexity associated with removal of soil along river	• Moderate to difficult technical complexity associated with removal of soil below groundwater table and need for structural support along existing building foundation	• Moderate to difficult technical complexity associated with removal of soil below groundwater table and need for structural support along existing building foundation	• Low technical complexity for construction of Engineered Barrier
b) Integration with Facility Operations	• Minimal effect on facility operations	• Minimal effect on facility operations	• Minimal effect on facility operations	• Minimal effect on facility operations • Use of remedial cap area could be diminished following installation
c) Monitoring, O&M or Site Access Requirements/ Limitations	• Moderate site use restrictions due to site AUL • Cap maintenance and AUL monitoring will be required	• Moderate site use restrictions due to site AUL	• No site use restrictions	• Moderate site use restrictions due to site AUL • Remedial Cap monitoring and documentation and AUL monitoring will be required
d) Availability of Services, Materials, Equipment or Specialists	• Readily available	• Readily available	• Readily available	• Readily available
e) Availability, Capacity and Location of Off-Site Treatment, Storage, and Disposal Facilities	• Off-site disposal facilities for impacted soil are readily available	• Off-site disposal facilities for impacted soil are readily available	• Off-site disposal facilities for impacted soil are readily available	• Off-site disposal facilities for impacted soil are readily available
f) Permits	• CSWPPP and trenching permit required for excavation • Possible requirement for Remediation General Permit or POTW discharge permit	• CSWPPP and trenching permit required for excavation • Requirement for Remediation General Permit or POTW discharge permit	• CSWPPP and trenching permit required for excavation • Requirement for Remediation General Permit or POTW discharge permit	• CSWPPP
Implementability Rating	Very Good	Good	Good	Very Good
Implementability Score	4	3	3	4

TABLE 5.1
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 1 – TITLEIST PROPERTY SOILS
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES			
	ALTERNATIVE OU1-1 Removal of PCB Impacted Soils in Upper Two Feet (<1 mg/kg) and at Depth (>100 mg.kg)	ALTERNATIVE OU1-2 Removal of PCB Impacted Soils at Concentrations Greater Than Commercial/Industrial Risk Based Concentration (4 mg/kg)	ALTERNATIVE OU1-3 Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)	ALTERNATIVE OU1-4 PCB Impacted Soils Addressed with Asphalt Cap (> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)
4. Cost				
a) Cost of Implementation (Not including Cost of Environmental Restoration)	• Moderate Capital Cost: $4.2 million NPV, 30 years: $4.4 million	• Moderate - High Capital Cost: $5.3 million NPV, 30 years: $5.5 million	• High Capital Cost: $6.3 million NPV, 30 years: $6.3 million	• Low Capital Cost: $0.7 million NPV, 30 years: $0.9 million Requires Financial Assurance Mechanism
b) Cost of Environmental Restoration and Potential Damages to Natural Resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources
c) Cost of Energy Consumption	• Moderate temporary energy consumption during removal, transportation and disposal of soil	• High temporary energy consumption during excavation and dewatering activities	• High temporary energy consumption during excavation and dewatering activities	• Moderate temporary energy consumption during remedy implementation
Cost Rating	Very Good	Fair	Poor	Good
Cost Score	4	2	1	3
5. Risk				
a) Risk during Implementation	• Moderate short-term risk to construction workers associated with use of heavy equipment and excavation of impacted soil • Low potential risk to public if transporting removed soils for disposal off-site	• Moderate short-term risk to construction workers associated with use of heavy equipment and excavation of impacted soil • Low potential risk to public if transporting removed soils for disposal off-site	• Moderate short-term risk to construction workers associated with use of heavy equipment and excavation of impacted soil • Low potential risk to public if transporting removed soils for disposal off-site	• Minimal short-term risk to construction workers associated with use of heavy equipment and excavation of minor volume of impacted soil
b) Risk during Operations	• Low potential risk to public or future site workers following remedial implementation	• Low potential risk to public or future site workers following remedial implementation	• No potential risk to public or future site workers/residents following remedial implementation	• Low potential risk to public or future site workers following remedial implementation
c) Risk associated with Remaining Oil and Hazardous Materials	• No Significant Risk following removal of impacted surface soil and >UCL soil, capping and AUL	• No Significant Risk following removal of impacted surface soil and >UCL soil and AUL	• No Significant Risk following removal of impacted soil > 1 mg/kg	• No Significant Risk to human health once asphalt cap and Engineered Barrier are in place
Risk Rating	Good	Good	Very Good	Good
Risk Score	3	3	4	3
6. Benefits				
a) Restores Natural Resources	• Not applicable	• Not applicable	• Not applicable	• Not applicable
b) Achieves Productive Reuse of Site	• Not applicable–property already used productively	• Not applicable–properties already used productively	• Not applicable–properties already used productively	• Not applicable–properties already used productively
c) Avoids Cost of Relocating People	• Not applicable	• Not applicable	• Not applicable	• Not applicable
d) Avoids Lost Value of Site	• Continued commercial/industrial use of site • No value lost	• Continued commercial/industrial use of site • No value lost	• Continued commercial/industrial use of site with possibility of residential use	• Continued commercial/industrial use of site • Remedial cap requires continued monitoring and maintenance and FAM
Benefits Rating	Good	Good	Very Good	Fair
Benefits Score	3	3	4	2

TABLE 5.1
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 1 – TITLEIST PROPERTY SOILS
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES			
	ALTERNATIVE OU1-1 Removal of PCB Impacted Soils in Upper Two Feet (<1 mg/kg) and at Depth (>100 mg.kg)	ALTERNATIVE OU1-2 Removal of PCB Impacted Soils at Concentrations Greater Than Commercial/Industrial Risk Based Concentration (4 mg/kg)	ALTERNATIVE OU1-3 Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)	ALTERNATIVE OU1-4 PCB Impacted Soils Addressed with Asphalt Cap (> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)
7. Timeliness				
a) Time to Eliminate Uncontrolled Sources and Achieve a Level of No Significant Risk	• Will achieve a level of No Significant Risk in a relatively short period of time due to removal of impacted surface soil	• Will achieve a level of No Significant Risk in a relatively short period of time due to removal of impacted surface soil	• Will achieve a level of No Significant Risk in a relatively short period of time due to removal of impacted surface soil	• Will achieve a level of No Significant Risk in a relatively short period of time due to installation of asphalt cap and Engineered Barrier
Timeliness Rating	Good	Good	Good	Good
Timeliness Score	3	3	3	3
8. Non-Pecuniary				
a) Aesthetics	• Existing area and landscaping will be restored to prior condition after excavation	• Existing area and landscaping will be restored to prior condition after excavation	• Existing area and landscaping will be restored to prior condition after excavation	• Existing area will be paved with asphalt
b) Community Acceptance	• Not likely to raise community concerns	• Not likely to raise community concerns	• Not likely to raise community concerns	• Asphalt remedial cap likely to raise community concerns due to loss of green space
Non-Pecuniary Rating	Good	Good	Very Good	Poor
Non-Pecuniary Score	3	3	4	1
9. Sustainable Remediation				
a) Eliminates or reduces to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem impacts, through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.	• Moderate sustainability – utilizes least amount of diesel fueled equipment, and off-site land disposal capacity (i.e. lowest carbon footprint) • Possibility to consolidate excavated soils beneath other OU remedial cap that would result in a higher sustainability rating • Maintain waterfront green front and provide permeable surface	• Low sustainability – utilizes diesel fueled equipment and off-site land disposal capacity • Possibility to consolidate excavated soils beneath other OU remedial cap that would result in a higher sustainability rating • Maintain waterfront green front and provide permeable surface	• Low sustainability – utilizes diesel fueled equipment and off-site land disposal capacity • Possibility to consolidate excavated soils beneath other OU remedial cap that would result in a higher sustainability rating • Maintain waterfront green front and provide permeable surface	• Low sustainability – utilizes diesel fueled equipment, asphalt • Creates impermeable surface increasing stormwater runoff from the site • Recycled material may be used in constructing cap
Sustainability Rating	Very Good	Good	Good	Poor
Sustainability Score	4	3	3	1
Overall Score	30	27	30	22

Notes:
1. Costs are preliminary
2. Scores are based on "1" being the lowest (poor), "2" corresponding with a Fair, "3" corresponding with Good and "4" being the highest (Very Good)
3. Overall Scores are preliminary and are not weighted

TABLE 5.2
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 2 – PRECIX PROPERTY VAPOR INTRUSION
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES		
	ALTERNATIVE OU2-1 Monitored Subslab Soil Gas Attenuation	ALTERNATIVE OU2-2 Vapor Barrier Over Floor Slab	ALTERNATIVE OU2-3 Active Subslab Depressurization System
1. Effectiveness			
a) Achieving a Permanent or Temporary Solution	• Current conditions and site uses provide a condition of No Significant Risk. Foreseeable future risks would not be addressed by monitored attenuation only unless/until other OU remedial activities address source materials or an Activity and Use Limitation eliminates future residential uses	• Current conditions and site uses provide a condition of No Significant Risk. Foreseeable future risks would not be addressed by monitored attenuation only unless/until other OU remedial activities address source materials. Passive pathway mitigation is not considered a Permanent Solution • Monitoring of vapor barrier integrity would be required	• May achieve a Permanent Solution as an Active Exposure Pathway Mitigation Measure (AEPMM) operated until remedial activities associated with OU3 effectively reduce source materials • Performance monitoring of SSDS and an AUL will be required to maintain the SSDS as an AEPMM (required to maintain Permanent Solution)
b) Reuse, Recycling, Destroying, Detoxifying or Treating Oil, and Hazardous Material	• Nearby OU remedial activities to address portion of source material coupled with natural degradation of TCE in groundwater plume • Alternative does not reuse or detoxify, solution relies on natural attenuation	• Nearby OU remedial activities to address portion of source material coupled with natural degradation of TCE in groundwater plume • Alternative does not reuse or detoxify, solution relies on engineering control	• Nearby OU remedial activities to address portion of source material coupled with slow natural degradation of TCE in groundwater plume • Alternative provides treatment of extracted vapors
c) Achieving or Approaching Background Concentrations	• In combination with the source control remedy for OU3, natural attenuation will reduce groundwater concentrations, but is not likely to achieve background in a reasonably foreseeable timeframe	• In combination with the source control remedy for OU3, natural attenuation will reduce groundwater concentrations, but is not likely to achieve background in a reasonably foreseeable timeframe	• In combination with the source control remedy for OU3, natural attenuation will reduce groundwater concentrations, but is not likely to achieve background in a reasonably foreseeable timeframe
Effectiveness Rating	**Fair**	**Fair**	**Good**
Effectiveness Score	**2**	**2**	**3**
2. Reliability			
a) Certainty of Success	• Probable success in conjunction with source remediation at other OUs	• Likely success in conjunction with source remediation at other OUs	• Highly successful via active mitigation and in conjunction with source remediation at other OUs
b) Effectiveness of Measures to Manage Residues or Control Emissions/Discharges	• No active measures required	• Effective at controlling vapor migration into building	• Effective at controlling vapor migration into building • Effective at managing emissions via carbon treatment when required
Reliability Rating	**Fair**	**Good**	**Very Good**
Reliability Score	**2**	**3**	**4**
3. Implementability			
a) Technical Complexity	• Low – Includes installation of subslab monitoring points and performance of long term monitoring	• Highly complex, would require nearly insurmountable logistics. Includes installation of vapor barrier requiring precise installation and sealing of penetrations.	• Moderate – Requires complex installation and system balancing • Once startup is completed and pressure differential, operation of the SSDS is relatively simple.
b) Integration with Facility Operations	• Low – Minor interruption of facility operations during installation of subslab monitoring points	• Extremely High – Requires significant disturbance of facility operations and interruption of production	• Moderate – Requires disturbance of facility operations
c) Monitoring, O&M or Site Access Requirements/ Limitations	• Access required for periodic monitoring	• Access required for periodic monitoring and maintenance of vapor barrier, and indoor air sampling	• Access required for periodic monitoring and maintenance of SSDS
d) Availability of Services, Materials, Equipment or Specialists	• Readily available	• Readily available	• Readily available
e) Availability, Capacity and Location of Off-Site Treatment, Storage, and Disposal Facilities	• Not applicable	• Not applicable	• Facilities for regeneration/disposal of carbon readily available
f) Permits	• No permits required	• No permits required	• Local permits required
Implementability Rating	**Very Good**	**Poor**	**Fair**
Implementability Score	**4**	**1**	**2**

TABLE 5.2
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 2 – PRECIX PROPERTY VAPOR INTRUSION
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES		
	ALTERNATIVE OU2-1 Monitored Subslab Soil Gas Attenuation	ALTERNATIVE OU2-2 Vapor Barrier Over Floor Slab	ALTERNATIVE OU2-3 Active Subslab Depressurization System
4. Cost			
a) Cost of Implementation (Not including Cost of Environmental Restoration)	• Low Capital Cost: \$0.1 million NPV, 30 years: \$0.8 million	• High Capital Cost: \$1.1 million NPV, 30 years: \$1.7 million • High collateral cost of lost production	• High Capital Cost: \$0.9 million NPV, 30 years: \$1.3 million
b) Cost of Environmental Restoration and Potential Damages to Natural Resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources
c) Cost of Energy Consumption	• Low	• Low	• Moderate
Cost Rating	Very Good	Fair	Fair
Cost Score	4	2	2
5. Risk			
a) Risk during Implementation	• Low short-term risk to construction workers associated with installation of subslab monitoring points	• Moderate short-term risk to construction workers associated with installation of subslab monitoring points and vapor barrier over floor slab	• Higher short-term risk to construction workers associated with installation of SSDS piping, heavy equipment, and installation of subslab monitoring points
b) Risk during Operations	• Low risk during monitoring	• Low risk during monitoring and maintenance	• Moderate risk during monitoring and maintenance of SSDS equipment and during transportation/disposal of carbon
c) Risk associated with Remaining Oil and Hazardous Materials	• No human health risks under current site uses provided indoor air concentrations do no increase during monitoring period • Unacceptable risk if future site uses or conditions change	• No human health risks under current site uses provided indoor air concentrations do no increase during monitoring period • Acceptable risk for future use provided vapor barrier effectiveness is maintained	• No human health risks under current site uses provided indoor air concentrations do no increase during monitoring period • Acceptable risk for future use provided SSDS effectiveness is maintained
Risk Rating	Fair	Good	Good
Risk Score	2	3	3
6. Benefits			
a) Restores Natural Resources	• Not applicable	• Not applicable	• Not applicable
b) Achieves Productive Reuse of Site	• Continued commercial/industrial use of site	• Continued commercial/industrial use of site	• Continued commercial/industrial use of site
c) Avoids Cost of Relocating People	• Not applicable	• Not applicable	• Not applicable
d) Avoids Lost Value of Site	• Continued commercial/industrial use of site • No value lost	• Continued commercial/industrial use of site • No value lost	• Continued commercial/industrial use of site • No value lost. Potential future use other than commercial/industrial when maintained with the operation of AEPMM.
Benefits Rating	Fair	Fair	Good
Benefits Score	2	2	3

TABLE 5.2
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 2 – PRECIX PROPERTY VAPOR INTRUSION
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES		
	ALTERNATIVE OU2-1 Monitored Subslab Soil Gas Attenuation	ALTERNATIVE OU2-2 Vapor Barrier Over Floor Slab	ALTERNATIVE OU2-3 Active Subslab Depressurization System
7. Timeliness			
a) Time to Eliminate Uncontrolled Sources and Achieve a Level of No Significant Risk	• Remedial action of other Site OU's will address contaminated soil and groundwater that are sources of vapor to indoor air	• Remedial action of other Site OU's will address contaminated soil and groundwater that are sources of vapor to indoor air	• Remedial action of other Site OU's will address contaminated soil and groundwater that are sources of vapor to indoor air
Timeliness Rating	Fair	Fair	Fair
Timeliness Score	2	2	2
8. Non-Pecuniary			
a) Aesthetics	• Minimal change to building aesthetics due to installation of subslab monitoring points	• Minimal change to building aesthetics due to the installation of the vapor barrier over the floor and the subslab monitoring points	• Moderate change to building aesthetics due to installation of subslab monitoring points and SSDS equipment/piping/components
Non-Pecuniary Rating	Good	Good	Fair
Non-Pecuniary Score	3	3	2
9. Sustainable Remediation			
a) Eliminates or reduces to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem impacts, through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.	• Highly sustainable, utilizes minimal resources	• Moderately sustainable – utilizes materials (sealants and/or liners), fuels for deliveries	• Lower sustainability – utilizes materials (piping, equipment, etc.), requires energy for continuous operations
Sustainability Rating	Very Good	Good	Fair
Sustainability Score	4	3	2
Overall Score	25	21	23

Notes:
1. Costs are preliminary
2. Scores are based on "1" being the lowest (poor), "2" corresponding with a Fair, "3" corresponding with Good and "4" being the highest (Very Good)
3. Overall Scores are preliminary and are not weighted

TABLE 5.3
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN SOILS AND GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES – PART A SOIL COMPONENTS		
	ALTERNATIVE OU3-A1 Removal and Off-Site Disposal of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE OU3-A2 Ex-Situ Treatment of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE OU3-A3 Asphalt Cap over Soils With PCB Concentrations > 2 mg/kg and Engineered Barrier Over Soils with Concentrations Above UCLs
• **Effectiveness**			
a) Achieving a Permanent or Temporary Solution	• High likelihood of achieving a Permanent Solution in a reasonable timeframe with site AUL	• High likelihood of achieving a Permanent Solution in a reasonable timeframe with site AUL	• High likelihood of achieving a Permanent Solution in a reasonable timeframe with site AUL
b) Reuse, Recycling, Destroying, Detoxifying or Treating Oil, and Hazardous Material	• Alternative does not reuse, recycle, destroy, detoxify, or treat OHM	• Alternative detoxifies OHM above the UCL	• Alternative does not reuse, recycle, destroy, detoxify, or treat OHM
c) Achieving or Approaching Background Concentrations	• Will not achieve or approach background concentrations in soil	• Will not achieve or approach background concentrations in soil	• Will not achieve or approach background concentrations in soil
Effectiveness Rating	Good	Good	Good
Effectiveness Score	3	3	3
• **Reliability**			
a) Certainty of Success	• Likely successful due to removal of soils above UCL provided a AUL is established and remedial cap is maintained	• Likely successful due to removal of soils above UCL provided a AUL is established and remedial cap is maintained	• Likely successful provided a AUL is established and remedial cap is maintained
b) Effectiveness of Measures to Manage Residues or Control Emissions/Discharges	• Effectiveness is dependent on AUL compliance	• Effectiveness is dependent on AUL compliance	• Effectiveness is dependent on AUL compliance • Residual contaminants beneath cap to be managed.
Reliability Rating	Good	Good	Good
Reliability Score	3	3	3
• **Implementability**			
a) Technical Complexity	• Low to moderate technical complexity associated with removal of soil along river	• High technical complexity to successfully treat soils above UCL	• Low technical complexity for construction of Engineered Barrier •
b) Integration with Facility Operations	• Site not currently in use. No disturbance to facility operations is anticipated.	• Site not currently in use. No disturbance to facility operations is anticipated.	• Site not currently in use. No disturbance to facility operations is anticipated.
c) Monitoring, O&M or Site Access Requirements/ Limitations	• Remedial Cap monitoring and maintenance will be required	• Remedial Cap monitoring and maintenance will be required	• Remedial Cap/Engineered Barrier monitoring, documentation, and maintenance will be required
d) Availability of Services, Materials, Equipment, or Specialists	• Readily available	• Moderately limited pool of specialty contractors experienced in ex-situ treatment of PCB contaminated soil	• Readily available
e) Availability, Capacity and Location of Off-Site Treatment, Storage, and Disposal Facilities	• Off-site disposal facilities for impacted soil are readily available	• Alternative does not include off-site disposal	• Alternative does not include off-site disposal
f) Permits	• Moderate level of effort	• Moderate to difficult level of effort depending on EPA approval for On-site treatment of soils (40 CFR 761.61)	• Low level of effort
Implementability Rating	Good	Fair	Very Good
Implementability Score	3	2	4

TABLE 5.3
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN SOILS AND GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES – PART A SOIL COMPONENTS		
	ALTERNATIVE OU3-A1 Removal and Off-Site Disposal of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE OU3-A2 Ex-Situ Treatment of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE OU3-A3 Asphalt Cap over Soils With PCB Concentrations > 2 mg/kg and Engineered Barrier Over Soils with Concentrations Above UCLs
• Cost			
a) Cost of Implementation (Not including Cost of Environmental Restoration)	• Very High Capital Cost: $22.7 million NPV, 30 years: $23.1 million	• Very High Capital Cost: $26.3 million NPV, 30 years: $26.7 million	• Low Capital Cost: $2.5 million NPV, 30 years: $2.9 million
b) Cost of Environmental Restoration and Potential Damages to Natural Resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources
c) Cost of Energy Consumption	• High temporary energy consumption during removal, transportation and disposal of soil, and during capping activities.	• Moderate to high temporary energy consumption during excavation and ex-situ treatment	• High temporary energy consumption during remedial capping activities.
Cost Rating	Poor	Poor	Very Good
Cost Score	1	1	4
• Risk			
a) Risk during Implementation	• Moderate short-term risk to construction workers associated with use of heavy equipment during excavation and loading of impacted soil • Potential short-term risk to public during transport and disposal of removed soil through neighborhood	• Moderate to high short-term risk to construction workers associated with use of heavy equipment during, excavation of impacted soil and ex-situ treatment	• Low short-term risk to construction workers associated with use of heavy equipment during excavation of smaller volume of impacted soil
b) Risk during Operations	• Low potential risk to future construction workers and future site workers	• Low potential risk to future construction workers and future site workers	• Low potential risk to future construction workers and future site workers
c) Risk associated with Remaining Oil and Hazardous Materials	• No Substantial Hazard following remedial implementation	• No Substantial Hazard following remedial implementation	• No Substantial Hazard following remedial implementation
Risk Rating	Fair	Fair	Good
Risk Score	2	2	3
• Benefits			
a) Restores Natural Resources	• Not applicable	• Not applicable	• Not applicable
b) Achieves Productive Reuse of Site	• Potential for future commercial/industrial reuse of site	• Potential for future commercial/industrial reuse of site	• Potential for future commercial/industrial reuse of site
c) Avoids Cost of Relocating People	• Not applicable	• Not applicable	• Not applicable
d) Avoids Lost Value of Site	• Potential for future commercial/industrial use of site • No value lost	• Potential for future commercial/industrial use of site • No value lost	• Potential for future commercial/industrial use of site • No value lost
Benefits Rating	Good	Good	Good
Benefits Score	3	3	3

TABLE 5.3
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN SOILS AND GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES – PART A SOIL COMPONENTS		
	ALTERNATIVE OU3-A1 Removal and Off-Site Disposal of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE OU3-A2 Ex-Situ Treatment of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg	ALTERNATIVE OU3-A3 Asphalt Cap over Soils With PCB Concentrations > 2 mg/kg and Engineered Barrier Over Soils with Concentrations Above UCLs
• Timeliness			
a) Time to Eliminate Uncontrolled Sources and Achieve a Level of No Significant Risk	• Will achieve a level of No Significant Risk in a relatively short period of time due to removal of soil with PCB concentrations above UCL	• Will achieve a level of No Significant Risk in a relatively moderate period of time due to ex-situ treatment of soil with PCB concentrations above UCL	• Will achieve a level of No Significant Risk in a relatively short period of time due to construction of asphalt cap and Engineered Barrier
Timeliness Rating	Very Good	Fair	Very Good
Timeliness Score	4	2	4
• Non-Pecuniary			
a) Aesthetics	• Existing area will be restored to prior condition	• Existing area will be restored to prior condition	• Existing area will be restored to prior condition
b) Community Acceptance	• Truck traffic may potentially raise community concerns	• Ex-situ treatment likely to raise community concerns	• Not likely to raise community concerns
Non-Pecuniary Rating	Good	Fair	Very Good
Non-Pecuniary Score	3	2	4
• Sustainable Remediation			
a) Eliminates or reduces to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem impacts, through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.	• Low sustainability – high diesel equipment use and off-site truck traffic	• Low to moderate sustainability – diesel equipment use	• Moderate sustainability – diesel equipment use and truck traffic • Recycled materials may be used in constructing the cap.
Sustainability Rating	Fair	Good	Good
Sustainability Score	2	3	3
Overall Score	24	21	31

Notes:
1. Costs are preliminary
2. Scores are based on "1" being the lowest (poor), "2" corresponding with a Fair, "3" corresponding with Good and "4" being the highest (Very Good)
3. Overall Scores are preliminary and are not weighted

TABLE 5.3
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN SOILS AND GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES – PART B GROUNDWATER COMPONENTS			
	ALTERNATIVE OU3-B1 Containment Via Vertical Barrier Wall	ALTERNATIVE OU3-B2 Containment via Vertical Barrier Wall and Hydraulic Containment	ALTERNATIVE OU3-B3 Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination	ALTERNATIVE OU3-B4 Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In-Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater Contamination
• **Effectiveness**				
d) Achieving a Permanent or Temporary Solution	• Will not achieve Permanent Solution due to flow of deep overburden groundwater beneath containment barrier to Acushnet River	• Moderate likelihood of achieving a Permanent Solution	• Moderate to high likelihood of achieving a Permanent Solution depending upon the timely effectiveness of the in-situ treatment.	• High likelihood of achieving a Permanent Solution
e) Reuse, Recycling, Destroying, Detoxifying or Treating Oil, and Hazardous Material	• Alternative does not reuse, recycle, destroy, detoxify, or treat OHM	• Alternative treats dissolved OHM in extracted groundwater prior to discharge	• Alternative treats dissolved OHM in extracted groundwater and soil in situ	• Alternative treats dissolved OHM in groundwater as it flows through permeable reactive barrier and soil hot spots in situ
f) Achieving or Approaching Background Concentrations	• Will not achieve or approach background concentrations in groundwater	• Will not achieve or approach background concentrations in groundwater	• Will not achieve or approach background concentrations in groundwater	• Will not achieve or approach background concentrations in groundwater
Effectiveness Rating	Poor	Good	Very Good	Very Good
Effectiveness Score	1	3	4	4
• **Reliability**				
c) Certainty of Success	• Unlikely to be successful, may only reduce by 50% the flow of dissolved constituents in groundwater into the Acushnet River	• Likely to be successful in preventing flow of dissolved constituents in overburden groundwater to Acushnet River in concentrations that would pose unacceptable risk to ecological receptors • Success dependent upon potentially longer term of remedy operation compared to other alternatives	• Likely to be successful in preventing flow of dissolved constituents in overburden groundwater to Acushnet River in concentrations that would pose unacceptable risk to ecological receptors • Likely to be successful at shortening the duration of operation with the addition of treatment	• Likely to be successful in preventing flow of dissolved constituents in overburden groundwater to Acushnet River in concentrations that would pose unacceptable risk to ecological receptors • Likely to be successful at shortening the duration of operation with the addition of treatment
d) Effectiveness of Measures to Manage Residues or Control Emissions/Discharges	• Will not be effective in controlling discharge of dissolved constituents in overburden groundwater to Acushnet River	• Will be effective in controlling discharge of dissolved constituents in overburden groundwater to Acushnet River • Above ground treatment system will be effective in controlling emissions to air or discharges of contaminated groundwater	• Will be effective in controlling discharge of dissolved constituents in overburden groundwater to Acushnet River • Above ground treatment system will be effective in controlling emissions to air or discharges of contaminated groundwater	• Will be effective in controlling discharge of dissolved constituents in overburden groundwater to Acushnet River • No ex-situ management of emissions and discharges
Reliability Rating	Poor	Fair	Good	Very Good
Reliability Score	1	2	3	4
• **Implementability**				
g) Technical Complexity	• Moderate technical complexity associated with installation of vertical containment barrier to bedrock	• Moderate technical complexity associated with installation of vertical containment barrier to bedrock • Moderate technical complexity associated with treating groundwater above ground	• Moderate technical complexity associated with installation of vertical containment barrier to bedrock • Moderate technical complexity associated with treating groundwater above ground • Moderate technical complexity associated with treating soil in situ	• Moderate technical complexity associated with installation of vertical containment barrier to bedrock • Moderate to high technical complexity associated with installing permeable reactive barrier that will treat both PCBs and CVOCs in a saline environment • Moderate technical complexity associated with treating soil in situ •
h) Integration with Facility Operations	• Site not currently in use. No disturbance to facility operations is anticipated.	• Site not currently in use. No disturbance to facility operations is anticipated.	• Site not currently in use. No disturbance to facility operations is anticipated.	• Site not currently in use. No disturbance to facility operations is anticipated.

TABLE 5.3
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN SOILS AND GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES – PART B GROUNDWATER COMPONENTS			
	ALTERNATIVE OU3-B1 Containment Via Vertical Barrier Wall	ALTERNATIVE OU3-B2 Containment via Vertical Barrier Wall and Hydraulic Containment	ALTERNATIVE OU3-B3 Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination	ALTERNATIVE OU3-B4 Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In-Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater Contamination
i) Monitoring, O&M or Site Access Requirements/ Limitations	• Monitoring of groundwater will be required • No access requirements or limitations	• Monitoring of groundwater will be required • Operation and maintenance of groundwater treatment system will be required • No access requirements or limitations	• Monitoring of groundwater will be required • Operation and maintenance of groundwater treatment system will be required • Operation of in situ soil treatment will be required • No access requirements or limitations	• Monitoring of groundwater will be required • Periodic PRB replacement may be required but no annual O&M • Operation of in situ soil treatment will be required • No access requirements or limitations
j) Availability of Services, Materials, Equipment, or Specialists	• Readily available	• Readily available • Requires licensed WWTP operator for quarterly inspections	• Readily available • Requires licensed WWTP operator for quarterly inspections	• Readily available
k) Availability, Capacity and Location of Off-Site Treatment, Storage, and Disposal Facilities	• No TSD facilities required	• Off-site TSD facilities for spent liquid and vapor phase GAC are readily available	• Off-site TSD facilities for spent liquid and vapor phase GAC are readily available	• Off-site TSD facilities for PRB construction spoils and spent PRB media are readily available
l) Permits	• CSWPPP and trenching permit required for excavation • Requirement for Remediation General Permit	• CSWPPP and trenching permit required for excavation • Requirement for Remediation General Permit • NPDES permit needed for discharge of treated groundwater to surface water or POTW permit required, added liability for potential noncompliance with limits • Local permits required to provide services to treatment equipment	• CSWPPP and trenching permit required for excavation • Requirement for Remediation General Permit • NPDES permit needed for discharge of treated groundwater to surface water or POTW permit required, added liability for potential noncompliance with limits • Local permits required to provide services to treatment equipment	• CSWPPP and trenching permit required for excavation • Requirement for Remediation General Permit
Implementability Rating	Very Good	Good	Fair	Good
Implementability Score	4	3	2	3
• **Cost**				
a) Cost of Implementation (Not including Cost of Environmental Restoration)	• Low Capital Cost: $2.7 million NPV, 30 years: $4.6 million	• High Capital Cost: $5.1 million NPV, 20 years: $13.9 million	• High Capital Cost: $6.8 million NPV, 30 years: $11.8 million	• Low Capital Cost: $5.1 million NPV, 30 years: $6.2 million
b) Cost of Environmental Restoration and Potential Damages to Natural Resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources
c) Cost of Energy Consumption	• Moderate energy consumption associated with installation of vertical containment barrier	• High energy consumption associated with installation of vertical containment barrier and operation of groundwater extraction and treatment	• Very high energy consumption associated with installation of vertical containment barrier, operation of groundwater extraction and treatment, and in situ treatment	• Moderate energy consumption associated with installation of vertical containment barrier and permeable reactive barrier, and insitu treatment
Cost Rating	Very Good	Fair	Poor	Good
Cost Score	4	2	1	3
• **Risk**				
a) Risk during Implementation	• Moderate short-term risk to construction workers associated with use of heavy equipment	• Moderate short-term risk to construction workers associated with use of heavy equipment • Low short term risk to construction workers during construction of groundwater treatment system	• Moderate short-term risk to construction workers associated with use of heavy equipment • Low short-term risk to construction workers during installation of injection points and construction of groundwater treatment system	• Moderate short-term risk to construction workers associated with use of heavy equipment and excavation of impacted soil along path of permeable reactive barrier • Low short term risk to construction workers during installation of injection points • Low short-term risk to public during transport and disposal of removed soil through neighborhood

TABLE 5.3
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN SOILS AND GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES – PART B GROUNDWATER COMPONENTS			
	ALTERNATIVE OU3-B1 Containment Via Vertical Barrier Wall	ALTERNATIVE OU3-B2 Containment via Vertical Barrier Wall and Hydraulic Containment	ALTERNATIVE OU3-B3 Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination	ALTERNATIVE OU3-B4 Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In-Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater Contamination
b) Risk during Operations	• Low potential risk to workers to monitor groundwater	• Low potential risk to workers to monitor groundwater • Moderate potential risk to workers during O&M of groundwater treatment system • Low but more frequent potential risk to public during transport and disposal of spent materials (bag filters, carbon etc.) from groundwater treatment system through neighborhood	• Low potential risk to workers to monitor groundwater • Moderate potential risk to workers during O&M of groundwater treatment system and injections for in situ treatment • Low but more frequent potential risk to public during transport and disposal of spent materials (bag filters, carbon etc.) from groundwater treatment system through neighborhood	• Low potential risk to workers to monitor groundwater • Low potential risk to public during transport and disposal of spent PRB media through neighborhood • Moderate potential risk to workers during injections for in situ treatment
c) Risk associated with Remaining Oil and Hazardous Materials	• Potential risk to environment from impacted groundwater flowing beneath vertical barrier and migrating to River • Low contaminant mass removal	• No Significant Risk to human health, safety, public welfare, or the environment once concentrations in hot spot areas are below UCLs. • Moderately aggressive contaminant mass removal	• No Significant Risk to human health, safety, public welfare, or the environment once concentrations in hot spot areas are below UCLs. • Moderately to highly aggressive contaminant mass removal	• No Significant Risk to human health, safety, public welfare, or the environment once concentrations in hot spot areas are below UCLs. • Moderately to highly aggressive contaminant mass removal
Risk Rating	Poor	Good	Good	Good
Risk Score	1	3	3	3
• **Benefits**				
a) Restores Natural Resources	• Not applicable	• Not applicable	• Not applicable	• Not applicable
b) Achieves Productive Reuse of Site	• Potential for future commercial/industrial reuse of site	• Potential for future commercial/industrial reuse of site	• Potential for future commercial/industrial reuse of site	• Potential for future commercial/industrial reuse of site
c) Avoids Cost of Relocating People	• Not applicable	• Not applicable	• Not applicable	• Not applicable
d) Avoids Lost Value of Site	• Potential for future commercial/industrial use of site • No value lost	• Potential for future commercial/industrial use of site • No value lost	• Potential for future commercial/industrial use of site • No value lost	• Potential for future commercial/industrial use of site • No value lost
Benefits Rating	Good	Good	Good	Good
Benefits Score	3	3	3	3
• **Timeliness**				
a) Time to Eliminate Uncontrolled Sources and Achieve a Level of No Significant Risk	• Will not eliminate uncontrolled sources or achieve a level of No Significant Risk in reasonable timeframe due to potential for impacted groundwater to migrate beneath vertical containment barrier	• Eliminates uncontrolled sources and achieves a level of No Significant Risk upon implementation, but longer operating period to achieve No Significant Risk	• Eliminates uncontrolled sources and achieves a level of No Significant Risk upon implementation	• Eliminates uncontrolled sources and achieves a level of No Significant Risk upon implementation
Timeliness Rating	Poor	Fair	Good	Good
Timeliness Score	1	2	3	3
• **Non-Pecuniary**				
a) Aesthetics	• Existing area will be restored to prior condition	• Existing area will be restored to prior condition	• Existing area will be restored to prior condition	• Existing area will be restored to prior condition
b) Community Acceptance	• Truck traffic may raise community concerns based on construction method selected	• Truck traffic may raise community concerns based on construction method selected • Discharge to river or POTW may raise community concerns	• Truck traffic may raise community concerns based on construction method selected • Discharge to river or POTW may raise community concerns	• Truck traffic may raise community concerns based on construction method selected
Non-Pecuniary Rating	Good	Fair	Fair	Good
Non-Pecuniary Score	3	2	2	3

TABLE 5.3
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 3 – AEROVOX PROPERTY OVERBURDEN SOILS AND GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES – PART B GROUNDWATER COMPONENTS			
	ALTERNATIVE OU3-B1 Containment Via Vertical Barrier Wall	ALTERNATIVE OU3-B2 Containment via Vertical Barrier Wall and Hydraulic Containment	ALTERNATIVE OU3-B3 Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination	ALTERNATIVE OU3-B4 Containment via Vertical Barrier Wall and Permeable Reactive Barrier and In-Situ Treatment of Soil Hot Spots Acting as a Source to Groundwater Contamination
• Sustainable Remediation				
a) Eliminates or reduces to the extent practicable total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem impacts through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.	• Moderate sustainability – high diesel equipment use and off-site truck traffic	• Low sustainability – high diesel equipment use and off-site truck traffic, and high energy use for long term operation of groundwater extraction and treatment system	• Low sustainability – high diesel equipment use and off-site truck traffic, and high energy use for long term operation of groundwater extraction and treatment system	• Moderate sustainability – high diesel equipment use and off-site truck traffic, reuse of recycled scrap iron
Sustainability Rating	Good	Fair	Fair	Good
Sustainability Score	3	2	2	3
Overall Score	21	22	23	29

Notes:
1. Costs are preliminary
2. Scores are based on "1" being the lowest (poor), "2" corresponding with a Fair, "3" corresponding with Good and "4" being the highest (Very Good)
3. Overall Scores are preliminary and are not weighted

TABLE 5.4
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 4 – SITEWIDE BEDROCK GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES	
	ALTERNATIVE OU4-1 In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation	ALTERNATIVE OU4-2 In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots and Monitored Natural Attenuation
1. Effectiveness		
a) Achieving a Permanent or Temporary Solution	• High likelihood of achieving a Permanent Solution	• High likelihood of achieving a Permanent Solution
b) Reuse, Recycling, Destroying, Detoxifying or Treating Oil, and Hazardous Material	• Alternative destroys DNAPL and lowers contaminant (CVOCs and PCB) concentrations to below applicable UCLs • Natural degradation of CVOCs and PCBs in groundwater plume	• Alternative volatilizes and mobilizes DNAPL and UCL exceedances so that they can be captured by multi-phase extraction wells and treated aboveground • Natural degradation of CVOCs and PCBs in groundwater plume
c) Achieving or Approaching Background Concentrations	• Will not achieve or approach background concentrations in groundwater	• Will not achieve or approach background concentrations in groundwater
Effectiveness Rating	**Good**	**Good**
Effectiveness Score	3	3
2. Reliability		
a) Certainty of Success	• High certainty of success	• Very high certainty of success
b) Effectiveness of Measures to Manage Residues or Control Emissions/Discharges	• No residuals or air emissions from ISCO treatment of hot spots	Vapor extraction system will be effective in capturing vapors generated from thermal treatment. Vapors will be treated at the surface.
Reliability Rating	**Good**	**Very Good**
Reliability Score	3	4
3. Implementability		
a) Technical Complexity	• High technical complexity associated with delivery and contact of oxidants with groundwater in fractured bedrock • Requires approximately 2 injections and 1 extraction wells per hot spot treatment area in deep bedrock (total of three) and 3 injection wells at one hot spot area in shallow bedrock.	• High technical complexity associated with in situ thermal treatment of fractured bedrock • Requires approximately 50 bedrock wells per area (heater borings, multi-phase extraction wells, steam injection wells, temperature monitoring holes) • High technical complexity associated with delivery and contact of oxidants with groundwater in fractured bedrock • Requires approximately 2 injection wells in the shallow bedrock hot spot area

TABLE 5.4
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 4 – SITEWIDE BEDROCK GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES	
	ALTERNATIVE OU4-1 In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation	ALTERNATIVE OU4-2 In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots and Monitored Natural Attenuation
b) Integration with Facility Operations	• No facility operations conducted in area where alternative will be implemented	• No facility operations conducted in area where alternative will be implemented
c) Monitoring, O&M or Site Access Requirements/ Limitations	• Monitoring of groundwater will be required • Multiple rounds of injections are anticipated to be required to achieve goals • No access requirements/limitations	• Monitoring of groundwater will be required • Operation, maintenance, and monitoring of groundwater and vapor treatment systems will be required • No access requirements/limitations • Multiple rounds of injections are anticipated to be required to achieve goals
d) Availability of Services, Materials, Equipment or Specialists	• Readily available	• An upgrade to the existing electrical service at the Site will be necessary to support the in situ thermal project
e) Availability, Capacity and Location of Off-Site Treatment, Storage, and Disposal Facilities	• No off-site disposal facilities required	• Off-site disposal facilities readily available for liquid and vapor phase carbon from groundwater/vapor treatment systems
f) Permits	• DEP approval required for application of chemical oxidants within 50 feet of River	• Will require a Federal Construction General Permit (CGP) and Remediation General Permit (RGP) • Will require a NPDES or POTW Permit for discharge of treated effluent from the groundwater treatment facility • DEP approval required for application of chemical oxidants within 50 feet of River
Implementability Rating	**Good**	**Poor**
Implementability Score	**3**	**1**
4. Cost		
a) Cost of Implementation (Not including Cost of Environmental Restoration)	• Low Capital Cost: $3.1 million NPV, 30 years: $3.8 million	• High Capital Cost: $11.2 million NPV, 30 years: $11.9 million

TABLE 5.4
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 4 – SITEWIDE BEDROCK GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES	
	ALTERNATIVE OU4-1 In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation	ALTERNATIVE OU4-2 In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots and Monitored Natural Attenuation
b) Cost of Environmental Restoration and Potential Damages to Natural Resources	• No cost for environmental restoration or damages to natural resources	• No cost for environmental restoration or damages to natural resources
c) Cost of Energy Consumption	• Low energy consumption during ISCO injections	• Very high energy consumption during thermal treatment and operation of groundwater/vapor treatment systems
Cost Rating	**Good**	**Poor**
Cost Score	**3**	**1**
5. Risk		
a) Risk during Implementation	• Low short-term risk to workers during installation of injection and extraction wells	• Low short-term risk to workers during installation of heating well or vapor extraction wells and groundwater treatment system • Low short-term risk to workers during installation of injection and extraction wells
b) Risk during Operations	• Low potential risk to workers to monitor groundwater • Moderate risk to workers during handling and injections of chemical oxidants and transport of chemicals to site • Low potential risk to public during transport of chemicals to site	• Low potential risk to workers to monitor groundwater • Low risk to workers during thermal treatment and operation of groundwater/vapor treatment systems • Low potential risk during liquid and vapor capture and treatment • Low potential risk to public during transport and disposal of spent liquid and vapor phase carbon • Moderate risk to workers during handling and injections of chemical oxidants and transport of chemicals to site • Low potential risk to public during transport of chemicals to site
c) Risk associated with Remaining Oil and Hazardous Materials	• No Significant Risk to human health, safety, public welfare, or the environment once concentrations are below UCLs.	• No Significant Risk to human health, safety, public welfare, or the environment once concentrations are below UCLs.
Risk Rating	**Good**	**Good**
Risk Score	**3**	**3**

TABLE 5.4
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 4 – SITEWIDE BEDROCK GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

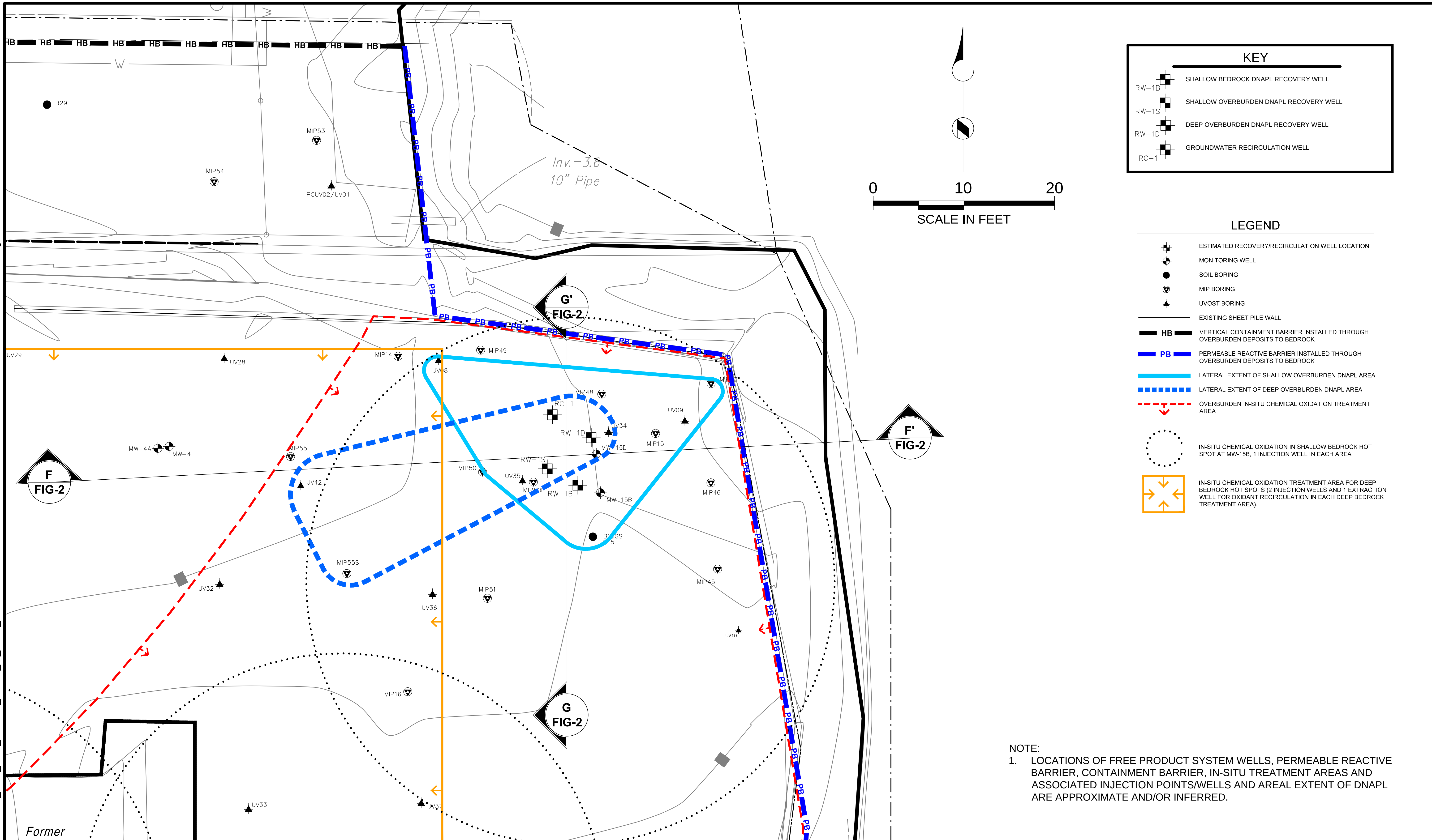
	REMEDIAL ACTION ALTERNATIVES	
	ALTERNATIVE OU4-1 In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation	ALTERNATIVE OU4-2 In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots and Monitored Natural Attenuation
6. Benefits		
a) Restores Natural Resources	• Not applicable	• Not applicable
b) Achieves Productive Reuse of Site	• Potential for future commercial/industrial reuse of site	• Potential for future commercial/industrial reuse of site
c) Avoids Cost of Relocating People	• Not applicable	• Not applicable
d) Avoids Lost Value of Site	• Potential for future commercial/industrial use of site • No value lost	• Potential for future commercial/industrial use of site • No value lost
Benefits Rating	**Good**	**Good**
Benefits Score	**3**	**3**
7. Timeliness		
a) Time to Eliminate Uncontrolled Sources and Achieve a Level of No Significant Risk	• Will reduce hot spots to below UCL concentrations in approximately 3 to 4 years.	• Thermal treatment will reduce hot spots in deep bedrock to below UCL concentrations in approximately 2 years. • Chemical oxidation will reduce the shallow bedrock hot spot to below UCL concentrations in approximately 3 to 4 years
Timeliness Rating	**Good**	**Very Good**
Timeliness Score	**3**	**4**
8. Non-Pecuniary		
a) Aesthetics	• No impact on aesthetics	• No impact on aesthetics
b) Community Acceptance	• Transport of oxidants may raise community concerns	• Transport of oxidants may raise community concerns
Non-Pecuniary Rating	**Good**	**Good**
Non-Pecuniary Score	**3**	**3**

TABLE 5.4
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
OPERABLE UNIT 4 – SITEWIDE BEDROCK GROUNDWATER
PHASE III REMEDIAL ACTION PLAN
FORMER AEROVOX FACILITY
NEW BEDFORD, MASSACHUSETTS

	REMEDIAL ACTION ALTERNATIVES	
	ALTERNATIVE OU4-1 In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation	ALTERNATIVE OU4-2 In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots and Monitored Natural Attenuation
9. Sustainable Remediation		
a) Eliminates or reduces to the extent of practicable, total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem impacts, through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.	• Moderate sustainability – use of chemicals for injection followed by natural attenuation to address impacts.	• Low sustainability – very high energy use • Moderate sustainability – use of chemicals for injection followed by natural attenuation to address impacts.
Sustainability Rating	**Good**	**Poor**
Sustainability Score	3	1
Overall Score	27	23

Notes:
1. Costs are preliminary
2. Scores are based on "1" being the lowest (poor), "2" corresponding with a Fair, "3" corresponding with Good and "4" being the highest (Very Good)
3. Overall Scores are preliminary and are not weighted

Appendix A: MW-15 DNAPL Area Cross-Section



NOTE:
1. LOCATIONS OF FREE PRODUCT SYSTEM WELLS, PERMEABLE REACTIVE BARRIER, CONTAINMENT BARRIER, IN-SITU TREATMENT AREAS AND ASSOCIATED INJECTION POINTS/WELLS AND AREAL EXTENT OF DNAPL ARE APPROXIMATE AND/OR INFERRED.

Brown AND Caldwell	SCALE: 1" = 10' 149279 DATE: August 22, 2016	FORMER AEROVOX FACILITY, NEW BEDFORD, MA. MW-15 AREA DETAIL	FIGURE 1

Path: H:\Projects\AVX\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL\Sections File Name: FIG-SectoionPlan Plot Date: August 22, 2016 5:16 PM Cadd User: Robert Near

Path: H:\Projects\AVX\149339_AVX_New_Bedford_Phase_III_RAP_CAD\2-SHEETS\C-CIVIL\Sections File Name: FIG-SectoionPlan Plot Date: August 22, 2016 5:13 PM Cadd User: Robert Near

LEGEND:

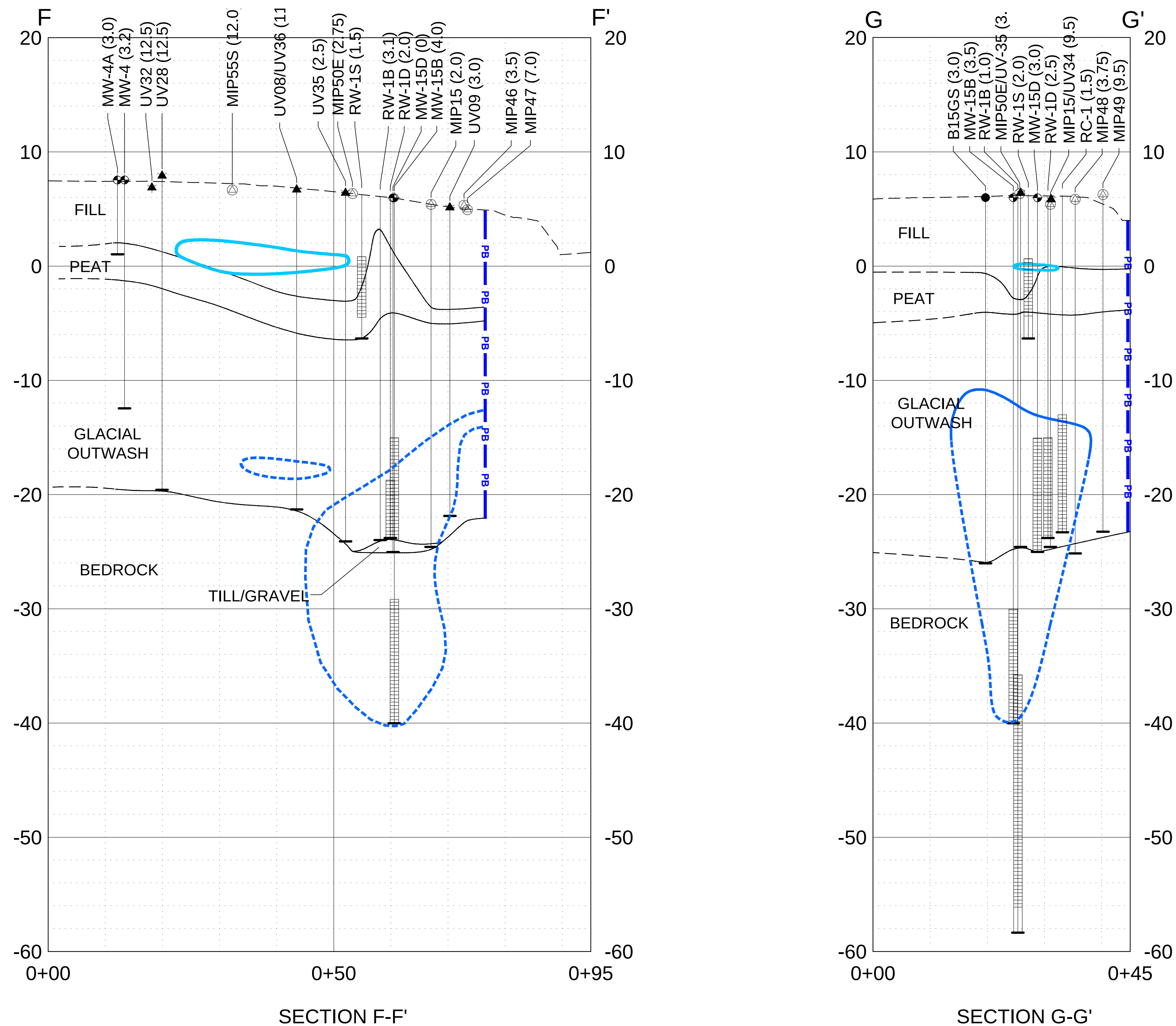
- EXTENT OF SHALLOW OVERBURDEN DNAPL
- EXTENT OF DEEP OVERBURDEN DNAPL
- PB — PB PERMEABLE REACTIVE BARRIER
- MONITORING WELL
- UVOST LOCATION
- MIP LOCATION

NOTES:

1. LOCATIONS, DEPTHS, AND INFERRED DNAPL AREAS ARE APPROXIMATE.
2. INFERRED DNAPL EXTENT BASED ON VISUAL IDENTIFICATION, UVOST, AND MIHPT LOGS.

0 20 40
SCALE IN FEET
HORIZONTAL

0 10 20
SCALE IN FEET
VERTICAL



Brown AND Caldwell	SCALE: AS SHOWN 149279 DATE: August 22, 2016	FORMER AEROVOX FACILITY, NEW BEDFORD, MA. SECTIONS F-F' AND G-G'	FIGURE 2

Appendix B: Mass Flux Calculation

Mass Flux Calculations - Former Aeroxov Facility

TCE Concentrations **Figure No.** C-C' Modified Cross Section

mf = kiA * C

Where:
- mf = mass flux, ug/s
- k = hydraulic conductivity, cm/s
- I = hydraulic gradient, dimensionless
- A = cross-sectional area, cm^2 (L*B)
- C = (ug/L)/1000=ug/cm^3

Mass Flux from Bedrock Groundwater to Downgradient Boundary of Site

Northern section (northern property line to midpoint between MW-34B and MW-07B) - shallow and medium bedrock

k =	1.2E-02	hydraulic conductivity, cm/s				Average k for slug tests in shallow bedrock from Phase II CSA is 34.9 feet/day
i =	0.00012	hydraulic gradient, dimensionless				Net horizontal gradient to River in shallow bedrock from Figures 2-16 and 2-19 of Phase II CSA
C=	72,800	ug/L =		72.8	ug/cm^3	Average concentration from MW-15B and MW-34B above 160 feet
L =	130	ft	=	3962.4	cm	Length of segment along cross section C-C'
b =	60	ft	=	1828.8	cm	Combined bedrock screened intervals for wells MW-15B and MW-34B above 160 feet
mf =	7.8E+02	ug/s		2.5E+04	g/yr	54.07 lbs/yr

Northern Section (northern property line to midpoint between MW-34B and MW-07B) - deep bedrock

k =	1.2E-02	hydraulic conductivity, cm/s				Shallow bedrock k from Phase II CSA (no deep bedrock k data)
i =	0.00012	hydraulic gradient, dimensionless				Net horizontal gradient to River in shallow bedrock from Figures 2-16 and 2-19 of Phase II CSA
C=	483,330	ug/L =		483.33	ug/cm^3	Concentration in MW-34B below 160 feet
L =	130	ft	=	3962.4	cm	Length of segment along cross section C-C'
b =	10	ft	=	304.8	cm	Screen interval in well MW-34B below 160 feet
mf =	8.6E+02	ug/s		2.7E+04	g/yr	59.83 lbs/yr

Southern Section (southern boundary of plume to midpoint between MW-07B and MW-34B) - shallow and medium bedrock

k =	1.2E-02	hydraulic conductivity, cm/s				Average k for slug tests in shallow bedrock from Phase II CSA is 34.9 feet/day
i =	0.00012	hydraulic gradient, dimensionless				Net horizontal gradient to River in shallow bedrock from Figures 2-16 and 2-19 of Phase II CSA
C=	7,040	ug/L =		7.04	ug/cm^3	Average concentration in wells MW-32B, MW-17B, MW-02 and MW-07B above 125 feet
L =	340	ft	=	10363.2	cm	Length of segment along cross section C-C'
b =	42	ft	=	1280.16	cm	Combined bedrock screened intervals for wells MW-32B, MW-17B, MW-02, and MW-07B above 125 feet
mf =	1.4E+02	ug/s		4.4E+03	g/yr	9.57 lbs/yr

Southern Section (southern boundary of plume to midpoint between MW-07B and MW-34B) - deep bedrock

k =	1.2E-02	hydraulic conductivity, cm/s				Average k for slug tests in shallow bedrock from Phase II CSA is 34.9 feet/day
i =	0.00012	hydraulic gradient, dimensionless				Net horizontal gradient to River in shallow bedrock from Figures 2-16 and 2-19 of Phase II CSA
C=	26500.00	ug/L =		26.5	ug/cm^3	Average concentration in well MW-32B below 125 feet
L =	340	ft	=	10363.2	cm	Length of segment between selected contours [C]
b =	20	ft	=	609.6	cm	Screened interval in MW-32B below 125 feet
mf =	2.5E+02	ug/s		7.8E+03	g/yr	17.16 lbs/yr
mf_{br} =	2027	ug/s		63919	g/yr	141 lbs/yr

Mass Flux Calculations - Former Aeroxov Facility

TCE Concentrations **Figure No.** C-C' Modified Cross Section

mf = kiA * C

Where:

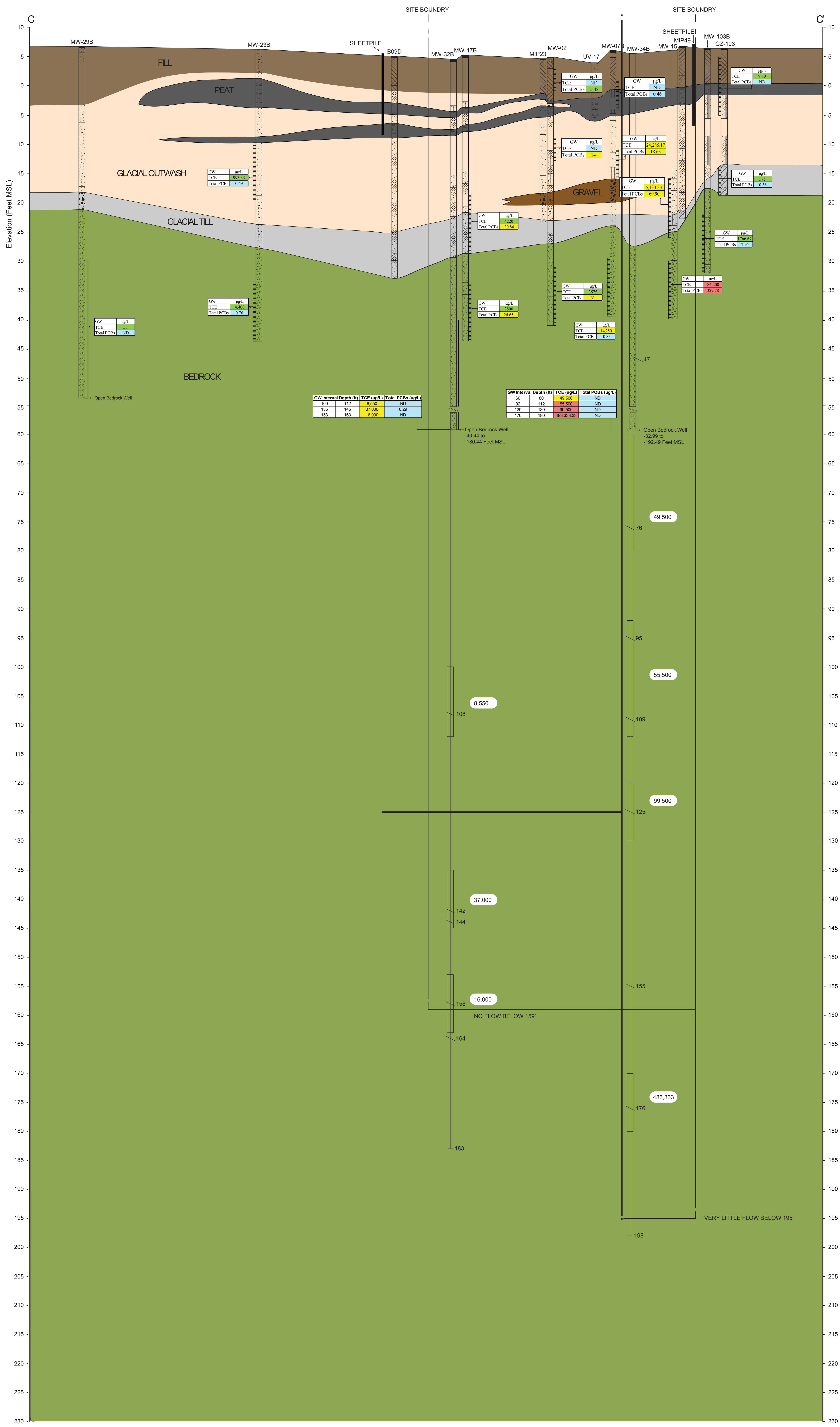
mf = mass flux, ug/s
k = hydraulic conductivity, cm/s
I = hydraulic gradient, dimensionless
A = cross-sectional area, cm^2 (L*B)
C = (ug/L)/1000=ug/cm^3

Vertical Discharge through Outwash Deposits

k =	4.4E-03	hydraulic conductivity, cm/s				One-tenth of horizontal k for outwash from Phase II CSA
i =	0.0023	hydraulic gradient, dimensionless				Average upward gradients measured in couplets on western side of site (MW-13D/B, MW-21D/21B, and MW-101S/101B)
L =	470	ft	=	14325.6	cm	Length of River section from north property boundary to southern width of shallow bedrock plume
x=	305	ft	=	9296.4	cm	Average distance to midpoint of River (measured at north middle and south sides of property)
q=	1.4E+03	cm3/sec				

Concentration in Outwash Deposits and Pore Water under River Adjacent to Site

mfbr=	2.0E+03	ug/s	
1/q=	7.4E-04	cm3/s	
mfbr/t*1/q=	1.49	ug/cm3	1490.32829 ug/l



GW Interval Depth (ft)		TCE (ug/L)	Total PCBs (ug/L)
100	112	8,550	ND
135	145	37,000	0.29
153	163	16,000	ND

GW Interval Depth (ft)		TCE (ug/L)	Total PCBs (ug/L)
60	80	49,500	ND
92	112	55,500	ND
120	130	99,500	ND
170	180	483,333.33	ND

LEGEND

Asphalt
Bedrock
Fill (made ground)
Concrete
Gravel
Gravelly Sand
Sand with Gravel
Sand with Silt
Sand
Silty Sand
Silty Sand with Gravel
Clayey Sand
Silt
Sandy Silt
Clay
Glacial Till
Organic Silt
Peat

GW Groundwater
TCE Trichloroethylene
PCBs Sum of Detected Aroclors
NS Not Sampled
ND Non-Detect
Lithologic Contact (Dashed where Inferred)

49,500 Sample Port in Deep Bedrock Well with TCE Concentration in UG/L
76 Depth of Major Fracture Zone in Feet below Ground Surface
Zones of Similar Concentration used in Mass Flux Calculations

Note: Sample Port Intervals from Table on page 2-11 of CSA

TCE (µg/L)	Total PCBs (µg/L)
≤5	≤5
>5	>5
>5,000 to ≤50,000	>10 to ≤100
>50,000	>100

Note: Groundwater concentrations shown represent average concentrations detected between December 2010 and August 2014

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EXPANDED GEOLOGIC CROSS-SECTION C-C' GROUNDWATER CONCENTRATIONS

Former Aerovox Facility | New Bedford, Massachusetts

Created By: HAB
Date: 07-28-2015
Figure: R-9

Appendix C: Groundwater Modeling

DRAFT

Groundwater Modeling Report
Former Aerovox Facility
New Bedford, Massachusetts

Prepared for

AVX Corporation, Myrtle Beach, South Carolina

July 2016

DRAFT

Groundwater Modeling Report
Former Aerovox Facility
New Bedford, Massachusetts

Prepared for

AVX Corporation

801 17th Avenue S.

Myrtle Beach, South Carolina 29577

July 2016

Project Number: 149339.001.002

This is a draft and is not intended to be a final representation of the work done or recommendations made by Brown and Caldwell. It should not be relied upon; consult the final report.

Brown AND Caldwell

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Upper Saddle River, New Jersey 07458

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List of Abbreviations

cm/sec	Centimeters per second
DEM	Digital Elevation Model
ft.	Feet
ft/day	Feet per day
GPM	Gallons per minute
SL	Mean Sea Level
NAVD	North American Vertical Datum of 1988
n_e	Effective porosity
PRB	Passive Reactive Barrier
Site	Former Aerovox Property
S_s	Specific storage
S_y	Specific yield

Section 1

Groundwater Flow Model

This report presents a numerical groundwater flow model that was developed to evaluate, confirm and, where appropriate, refine the understanding of groundwater behavior in and around the Former Aerovox property (Site) to support the development of a Phase III Remedial Action Plan. A calibrated groundwater model was developed as an estimation of current groundwater behavior and was subsequently used to:

- Evaluate how groundwater would be influenced by the implementation of various remedial alternatives that may be considered;
- Assess whether, and the degree to which remedial alternatives would require groundwater management (e.g., groundwater extraction, containment, etc.); and
- Provide an initial evaluation of approaches for groundwater management, if required.

This model was constructed as a screening level exercise and additional data collection may be required to further refine the model to decrease uncertainty in the results.

1.1 Model Construction

The Modular Three-dimensional Finite Difference Groundwater Flow Model (MODFLOW) was selected for the groundwater flow simulation. This modeling code was developed by the United States Geological Survey (McDonald and Harbaugh, 1988) in the early 1980's based on theoretical flow behavior defined by Darcy's Law. The MODFLOW code is well proven and is accepted by industry and by regulatory agencies for application to porous media flow systems, and remains today as the de facto standard code for groundwater modeling. The specific version of MODFLOW used was MODFLOW 2000, and the graphical user interface used to input the model components into the model was Groundwater Vistas 6 from Environmental Simulations, Inc.

Site data, including in-situ hydraulic conductivity test (slug test) results, soil characteristics described in borings, and water elevation data collected from the monitoring wells, were used to construct and calibrate the model. These data and information are available in the "Phase II Comprehensive Site Assessment" (AECOM, September 2015). The model also incorporated publicly available regional data, where available, such as the USGS Digital Elevation Model (DEM) data to provide regional surface topography

1.1.1 Model Domain

The model domain (Figure 1-1) consists of a grid of 150 columns and 200 rows covering an area that is approximately 0.43 square miles in extent. The Site is located near the center of the grid. The columns and rows are of a uniform 20 feet (ft) by 20 ft size (Figure 1-2). The eastern edge of the model is bounded by the Acushnet River, while the western edge is based off of a ground surface elevation contour of 10 ft above Mean Sea Level (MSL) by the North American Vertical Datum of 1988 (NAVD). The model is extended approximately 1500 ft north and south of the property boundaries.

The model was constructed with three layers (Figure 1-3). These layers were incorporated into the model to represent significant hydrostratigraphic units within the domain, as described below. Both the thickness and the elevation of these layers vary horizontally to account for spatial changes in topography and stratigraphy. The top and bottom elevations of the hydrostratigraphic units in the vicinity of the Site were estimated based on Site boring logs. These values were contoured using the kriging method to create layer surfaces that were imported into the model by the modeling software. In model areas located outside the boundaries of the Site, where subsurface boring data are limited or unavailable, thicknesses and elevations were assumed for the stratigraphic units based on the geologic understanding of the extent of these units. The bottom of the lowermost unit modeled (Layer 3) was assigned a constant elevation of -300 ft NAVD.

The nature of the various stratigraphic units beneath the Site, and the conceptual model of groundwater flow are described in Section 2.2 of the Phase II Comprehensive Site Assessment (CSA). The hydrostratigraphic units incorporated into the model include:

- Model Layer 1: Artificial Fill and Peat Units.
- Model Layer 2: Glacial Outwash and Till
- Model Layer 3: Bedrock

1.1.2 Boundary Conditions

Boundary conditions are simulations of natural and artificial features, such as streams, drains, extractions wells, surficial recharge, etc., that control water entering and leaving a model's domain. The boundary conditions for this particular model are described in the sections below.

1.1.2.1 Inflow of Water

The flow of water into the model was simulated by applying a constant head boundary to a single row of cells along the western edge of the model. The elevation of this constant head boundary was modified during the calibration of the model to a final value of 4.1 ft NAVD. This boundary condition is represented on Figure 1-4

In addition to the constant head boundary a surface recharge boundary was applied to the topmost layer of the model. A single recharge value of 10 inches/year was utilized over the model domain.

1.1.2.2 Outflow of Water

The flow of water out of the model was simulated by applying a constant head boundary to the area of the model domain that represents the Acushnet River. This constant head boundary was set to a constant elevation of 0 ft NAVD to generate the heads adjacent to the river that are representative of a low-tide condition. Tidal variations in the Acushnet River, as presented in the Phase II CSA reach an elevation of approximately -1 ft NAVD. However these are transient conditions and an elevation of -1 ft in the steady-state version of the model calculated heads at the Site that were too low relative to heads measured at the site. This boundary condition is represented on Figure 1-4.

1.1.2.3 Sheet Pile Wall

The code's hydraulic barrier module was utilized to simulate the existing sheet-pile walls along the shoreline of the property and the adjacent Precix property. These hydraulic barriers were simulated across the thickness of model layer 1, which represents the fill and peat units. The hydraulic barrier was given a thickness of 1 ft and a hydraulic conductivity of 1E-07 centimeters/second (cm/sec). These values may not match the actual properties of the sheet-pile but they provide the necessary degree of impermeability to reduce tidal fluctuations in the fill unit behind them, as was documented in the Phase II CSA. These boundary conditions are represented on Figure 1-4.

1.1.3 Hydrogeologic Properties of Layers

The table below identifies the hydraulic conductivities assigned to each of the model layers. In addition, Figure 1-5 presents a cross-section from the model that illustrates the distribution of hydraulic conductivities across the Site. The horizontal hydraulic conductivities assigned to each of the units (denoted as Kx and Ky, or, Kx,y, since horizontal K is assumed the same regardless of flow direction in this model) were initially approximated from soil descriptions from soil borings and slug test results from wells as reported in the Phase II CSA. The values were subsequently refined during the calibration process. Thus, the hydraulic conductivity values assigned to the model, following calibration, are as follows:

Table 1-1. Hydraulic Conductivity

Unit	Model Layer	Kx,y (ft/day)	Kz (ft/day)
Fill Unit	1	18.1	1.81
Fill Unit where Peat is Present	1	18.1	0.0002834
Glacial Outwash/Till	2	34.1	3.41
Bedrock	3	8.96	8.96

It was assumed for units of generally consistent grain size (i.e., Glacial Outwash) that the vertical hydraulic conductivity (Kz) was at least one-half order of magnitude less than the Kx,y. This assumption is consistent with the literature, which indicates Kz to Kx,y ratios ranging from 0.1 to 0.95 for unconsolidated deposits, with the more granular deposits, such as sand exhibiting the higher ratios and clay-dominated deposits exhibiting the lower ratios (Spitz and Moreno, 1996). The degree of anisotropy of hydraulic conductivity in the bedrock unit has not been defined. As such the same value was utilized for the horizontal and vertical hydraulic conductivities for the bedrock unit.

The fill unit simulated as Layer 1 of the groundwater flow model was separated into two sub-units. The first represents the fill in areas where it is not underlain by peat materials. The second sub-unit represents the areas where the fill is underlain by peat materials, as delineated in the Phase II CSA. For the second sub-unit the vertical conductivity of the layer was reduced significantly from 1.81 feet/day (ft/day) to 0.0002834 ft/day to represent the relative impermeability of the peat materials to vertical flow. This alteration was necessary to produce the heads in the fill near the river that are minimally effected by tidal fluctuations that are described in Section 2.1, below.

1.2 Model Calibration

The groundwater flow model was calibrated under steady-state conditions by comparing model calculated groundwater levels to monitoring well levels measured on May 28, 2015. These measurements were taken during a low-tide condition, which is the state that the Steady-state version of the groundwater model was developed to simulate. A total of 47 measurements were utilized for the calibration. Several other well readings were not used, including five overburden wells, GZ-2, MW-1, MW-2A, MW-3 (AVX), and MW-4A. Readings from these five wells were suspected of representing perched conditions above the peat, which the groundwater model, as designed, is unable to simulate.

To obtain the best-fit correlation between model-calculated water levels and measured water levels, the hydraulic conductivity of the units, recharge values and the elevations of the constant head boundaries were subjected to adjustments; these adjustments were made within the range of values expected for the type of deposit or boundary condition.

A plot comparing the measured (observed) groundwater head elevations to model-computed groundwater heads, as well as statistics to evaluate the degree to which the model values match the observed values, is provided in Figure 1-7. These statistics indicate that model calculated groundwater elevations in the final calibrated model match well to actual groundwater elevation measurements obtained on May 28, 2015. This comparison yields a high correlation coefficient of 0.96, a mean absolute error of -0.2 ft, and a normalized root mean square error (RMS) of 8.5%, all considered indicators of a reasonable match between modeled and observed values.

The calibrated steady-state groundwater head equipotential contours for the Fill unit (Layer 1), Glacial Outwash Unit (Layer 2), and Bedrock Unit (Layer 3), are displayed in Figures 1-8, 1-9, and 1-10, respectively. Figure 1-11 provides a cross-section across the model domain, showing a vertical profile of groundwater head value contours.

1.3 Model Sensitivity

To determine the degree of uncertainty associated with the calibrated model, a sensitivity analysis was performed by varying the hydraulic conductivity (both horizontal and vertical) of all units by factors of 2, one-half order of magnitude, and one order of magnitude. For each variation of the model, the resulting Sum of Square Residuals was calculated. The statistical results of the sensitivity analyses are summarized in the following tables.

Table 1-2. Horizontal Conductivity Sensitivity – Sum of Square Residuals

Factor Relative to Calibrated Values	Fill	Fill where Peat is Present	Glacial Outwash	Bedrock
0.1	2.66	10.66	6.00	2.49
0.5	2.36	4.54	4.98	1.80
0.5	2.10	2.30	3.19	1.51
1	1.91	1.91	1.91	1.91
2	1.70	1.79	1.68	5.86
5	1.53	1.87	5.40	31.14
10	1.84	2.24	12.25	79.68

Table 1-3. Vertical Conductivity Sensitivity – Sum of Square Residuals

Factor Relative to Calibrated Values	Fill	Fill where Peat is Present	Glacial Outwash	Bedrock
0.1	8.47	1.91	21.91	21.87
0.5	4.11	1.91	8.79	9.54
0.5	2.32	1.91	3.04	3.25
1	1.91	1.91	1.91	1.91
2	1.75	1.90	1.58	1.56
5	1.67	1.89	1.50	1.54
10	1.65	1.88	1.49	1.57

These statistics indicate that the groundwater model is sensitive to horizontal hydraulic conductivity variations in the Glacial Outwash and Bedrock units, particularly to increases in the horizontal conductivity of the bedrock. The model is also sensitive to reductions in the vertical conductivity of recharge to these units. While some variations produced statistically slightly better results than the calibrated model, particularly increases in the vertical conductivity of the Glacial Outwash and Bedrock Units, the empirically derived values taken from the Phase II CSA were maintained in the Model. Additional hydraulic testing in the future could provide additional data to refine these values.

1.4 Conversion to Transient Operation

The tidal cycle within the Acushnet River has significant impact on the groundwater elevation and flow directions at the Site. The alternating flow directions caused by the tidal fluctuations present a complication for the evaluation of remedial alternatives. The remedial alternative selected will need to meet its design objectives at both low tide and high tide conditions. As such the calibrated steady-state groundwater model was converted to operate on a transient basis with a simulated tidal cycle to evaluate the effects these variations have on the effectiveness of each alternative in preventing migration of site constituents and the amount of groundwater management required.

The transient model was developed to first run a steady-state simulation in order to generate starting heads for the transient component of the simulation. The tidal cycles documented in the Phase II CSA varied between approximately 4.2 and -1.0 ft NAVD. A starting steady-state head level of 1.5 ft NAVD was selected to produce an approximately average condition in the model prior to the transient portion of the simulation.

After the steady-state starting heads were calculated the model was run in transient mode for a simulated period of approximately 3.5 days, representing 7 tidal cycles. During this period the head levels in the constant-head boundary condition representing the Acushnet River were varied. The heads are varied in hourly increments to create a sinusoidal variation that approximates the tidal cycles documented in the Phase II CSA. These cycles have high tide elevations of 4.2 ft NAVD and low tide elevations of -1 ft NAVD. Simulating multiple repetitions of the tidal cycle was necessary to confirm that groundwater elevations would return after each cycle to levels estimated by the steady-state model and not drift new levels.

The boundary condition representing the Acushnet River was copied from layer 1 to also be simulated in layer 2 and 3. This was found to be necessary to propagate the observed tidal fluctuations through the Glacial Outwash and Bedrock units. This is consistent with the Site Conceptual Model, which assumes that the Acushnet River is in direct hydraulic communication with these units.

Once the transient simulation was developed, the transient parameters specific storage (S_s), specific yield (S_y) and effective porosity (n_e) were adjusted to control the tidal variations within the aquifers to produce simulated head variations in the target wells to match the variations documented in Appendix H of the Phase II CSA. The values selected are documented in Table 2-1 below. Since it is assumed that all three units are behaving as unconfined aquifers, the specific storage is negligible relative to the specific yield, which is the ratio of the fraction of the bulk aquifer volume that a given aquifer will yield when all the water is allowed to drain out of it. This value is always less than the effective porosity.

Table 2-1. Transient Properties

Unit	Model Layer	Specific Storage (ft^{-1})	Specific Yield	Effective Porosity
Fill Unit	1	5e-005	0.20	0.30
Glacial Outwash/Till	2	5e-005	0.22	0.25
Bedrock	3	5e-005	0.05	0.10

Section 2

Simulations of Remedial Alternative

The transient model was used as the basis for a series of simulations that were used to evaluate the effect of the various remedial alternatives on groundwater flow, and to estimate potential groundwater management needs for the alternatives. The various remedial alternatives that were simulated are discussed below. The specific objectives of the simulations included the following:

- Evaluate the effectiveness of the proposed remedial alternatives on preventing the migration of impacted groundwater off-Site.
- Estimate the amount of groundwater that might be required to be managed to meet remedial objectives (i.e., to mitigate off-property migration of dissolved-phase constituents and reduce the potential for unacceptable groundwater level increase [e.g., groundwater mounding, flooding]).

In the modeled remedial alternative scenarios discussed below that include groundwater extraction, it was assumed that wells would be used to extract groundwater. However, other technologies may be considered in the detailed design, such as french drains. Note that the number of extraction wells assumed in each scenario, and their position and rate of pumping, are meant to be generally representative and would be subject to modification and optimization in the detailed design if a given alternative is selected.

2.1 Remedial Scenario 1 – Fully Enclosing Barrier Wall with Low Permeability Cap

Remedial Scenario 1 modifies the transient simulation discussed in Section 2.1, above, by simulating a low-permeability barrier wall across the unconsolidated Fill/Peat and Glacial Outwash/Till units simulated in layers 1 and 2. This barrier wall was simulated to surround the eastern half of the property, as shown on Figures 2-1. This extent was selected to contain the groundwater impacted that is above GW-3 groundwater criteria. The wall was simulated using the horizontal flow barrier module with a thickness of 1 foot and a hydraulic conductivity of 1E-07 cm/sec. A low-permeability surface cap was also simulated over the extent of the contained area by reducing the surface recharge to 0 inches/year in this area.

The groundwater flow model indicates (Figures 2-2 and 2-3) that the barrier wall would likely reduce the amplitude of tidal fluctuation in the Glacial Outwash unit (Layer 2). Only layer 2 is presented as the glacial outwash unit is the principal transmissive unconsolidated unit. The barrier wall does not fully dampen the tidal cycle in the contained overburden, however, since the tidally affected bedrock remains in direct communication with the overlying overburden.

In addition, the barrier wall does not prevent the discharge of impacted groundwater from the overburden units to the Acushnet River. Particle flow tracking indicates that vertical communication between the overburden layers and the underlying bedrock will allow water to flow vertically downward into the bedrock, bypassing underneath the Barrier Wall, before discharging to the river. The barrier wall does, however, reduce the estimated groundwater flux through the contained overburden by approximately 50%. This is due to the more circuitous route groundwater from the overburden units must take to discharge to the river, as well as the reduced gradients and tidal fluctuations caused by the barrier wall.

The groundwater equipotential contours for Scenario 1 in Layer 2 at low and high tide conditions are presented in Figures 2-4 and 2-5, respectively. The groundwater equipotential contours for Scenario 1 in cross-section at low and high tide are presented in Figures 2-5 and 2-6, respectively.

2.2 Remedial Scenario 2 – Fully Enclosing Barrier Wall with Low Permeability Cap and Groundwater Extraction

Remedial Scenario 2 modifies Scenario 1 by adding constant flux boundaries to simulate extraction wells within the contained area. Five wells were simulated, three along the downgradient edge of the contained area and two along the upgradient edge (Figures 2-6). The extraction rates of the wells were adjusted iteratively until no groundwater discharged out of the contained overburden at either high or low tide conditions. This condition was achieved with the three downgradient wells extracting 15 gallons/minute (GPM) each and the two upgradient wells extracting ten GPM each for a total of 65 GPM.

The groundwater equipotential contours for Scenario 2 in Layer 2 at low and high tide conditions are presented in Figures 2-7 and 2-8, respectively. The groundwater equipotential contours for Scenario 2 in cross-section at low and high tide are presented in Figures 2-9 and 2-10, respectively.

2.3 Remedial Scenario 3 – Passive Reactive Barrier with Lateral Barrier walls and Low Permeability Cap

Remedial Scenario 3 modifies the transient simulation described in Section 2.1 by simulating a Passive Reactive Barrier (PRB) along the shoreline of the property across the unconsolidated Fill/Peat and Glacial Outwash/Till units (Figures 2-1). This PRB was simulated using the horizontal flow barrier module with a thickness of 3 ft and a hydraulic conductivity of 28 ft/day. This conductivity is similar to the modeled hydraulic conductivity of the glacial outwash unit, which is 34 ft/day. To direct groundwater flow through the PRB rather than around the northern or southern edges of the PRB, the northern and southern barrier walls simulated in Scenarios 1 and 2 are also included in Scenario 3. Scenario 3 does not, however, utilize an upgradient barrier wall along the western edge of the contained area.

Flow direction through the PRB alternates with the tidal fluctuations. As a result, the PRB is only treating impacted Site groundwater during lower tide conditions. Based on preliminary mass balance calculations from the model approximately 99% of water existing in the contained area of the glacial outwash materials will pass through the PRB. During high tide the flow direction is reversed and water enters the contained area from the Acushnet River, through the PRB. During high tide some groundwater flows from the contained area of the glacial outwash deposits downward into the bedrock unit. The rate of this downward flow, however, is similar to the rate of upward flow from the bedrock during low tide conditions. This indicates that little net flux is expected between these two units in the contained area following construction of the PRB and lateral hydraulic barriers.

The groundwater equipotential contours for Scenario 3 in Layer 2 at low and high tide conditions are presented in Figures 2-12 and 2-13, respectively. The groundwater equipotential contours for Scenario 3 in cross-section at low and high tide are presented in Figures 2-14 and 2-15, respectively.

Section 3

Conclusions

The following conclusions have been made from the groundwater flow model simulations conducted to evaluate remedial alternative scenarios for the former Aerovox property:

- The construction of a hydraulic barrier installed to the bedrock will require groundwater control measures in the form of groundwater extraction to maintain inward and upward hydraulic gradients into the area to prevent migration of Site COCs in the overburden offsite.
- Groundwater extraction rates to maintain hydraulic control of heads within the simulated hydraulic barrier throughout a tidal cycle can be expected to be on the order of 65 gallons per minute.
- Groundwater extraction within the overburden units has the potential to capture some of the impacted groundwater within the shallow bedrock unit.
- A PRB installed across the unconsolidated units at the downgradient side of the property can be expected to treat nearly all water in the overburden units impacted by site constituents when paired with parallel hydraulic barriers to prevent lateral migration around the PRB.

Section 4

Limitations

This groundwater model, like all others, cannot simulate groundwater behavior with absolute certainty, but rather provides an estimate of flow behavior based on the current understanding of subsurface conditions at the Site. Missing information, or data gaps, are addressed to the extent possible using assumptions that are based on general geologic principles, regional geologic data, where available and ascertainable, or information generated from studies performed in like settings that are documented in the scientific literature. The use of these indirect sources of data creates a level of uncertainty, as conditions may be different from those assumed.   Sensitivity analyses have been performed in an attempt to quantify uncertainties. However, despite all efforts to reduce or quantify uncertainty, subsurface conditions may nonetheless exist that are not predictable and which could result in groundwater behavior that is significantly different than that simulated by the groundwater model.

Section 5

References

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McDonald and Harbaugh, 1988 “A Modular, Three-Dimensional Finite-Difference Groundwater Flow Model,” Techniques of Water-Resources Investigations, Book 6, U.S. Geological Survey

Spitz and Moreno, 1996. “A Practical Guide to Groundwater and Solute Transport Modeling”. John Wiley and Sons Inc.

Figures

7/28/2016

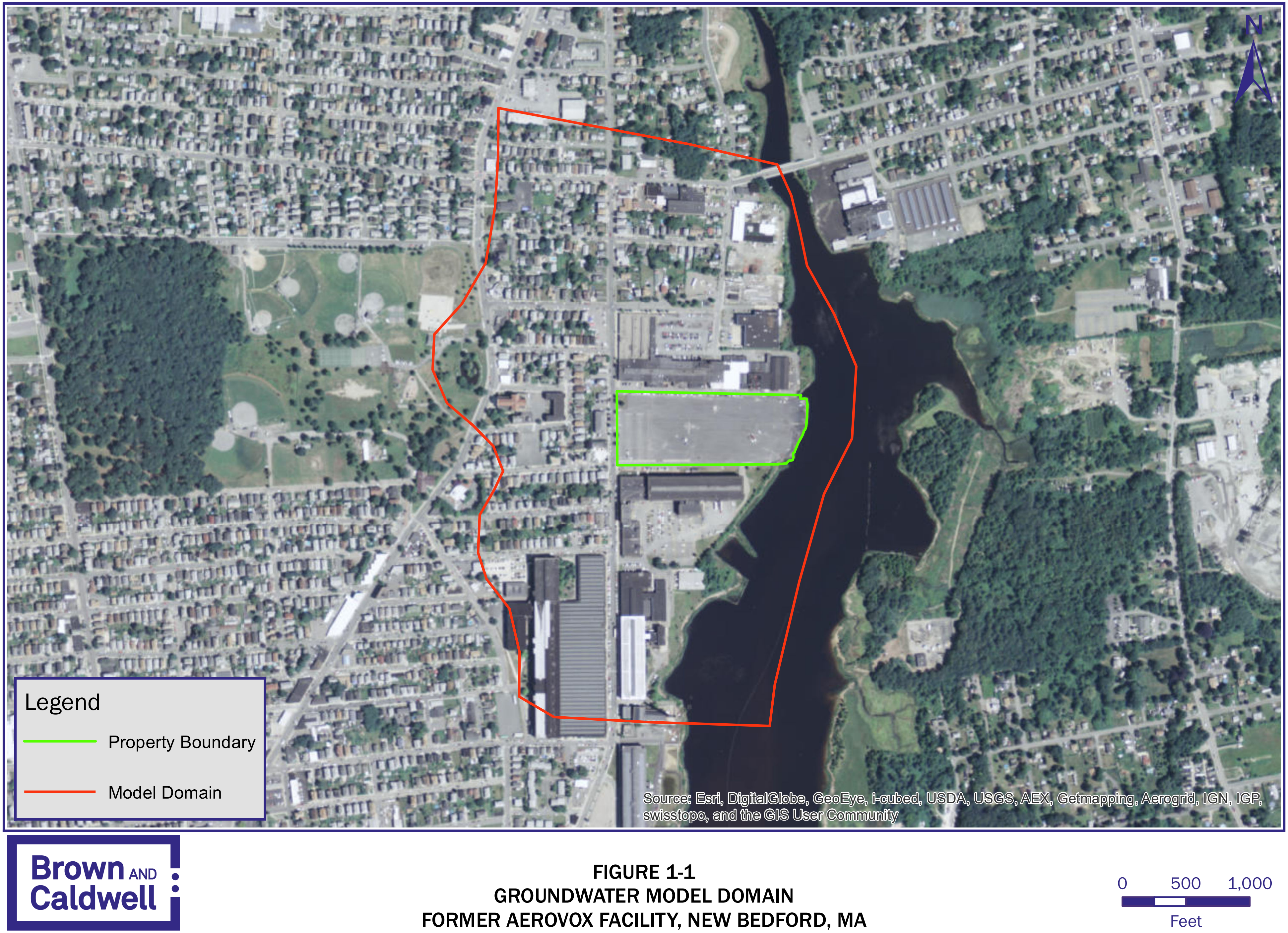

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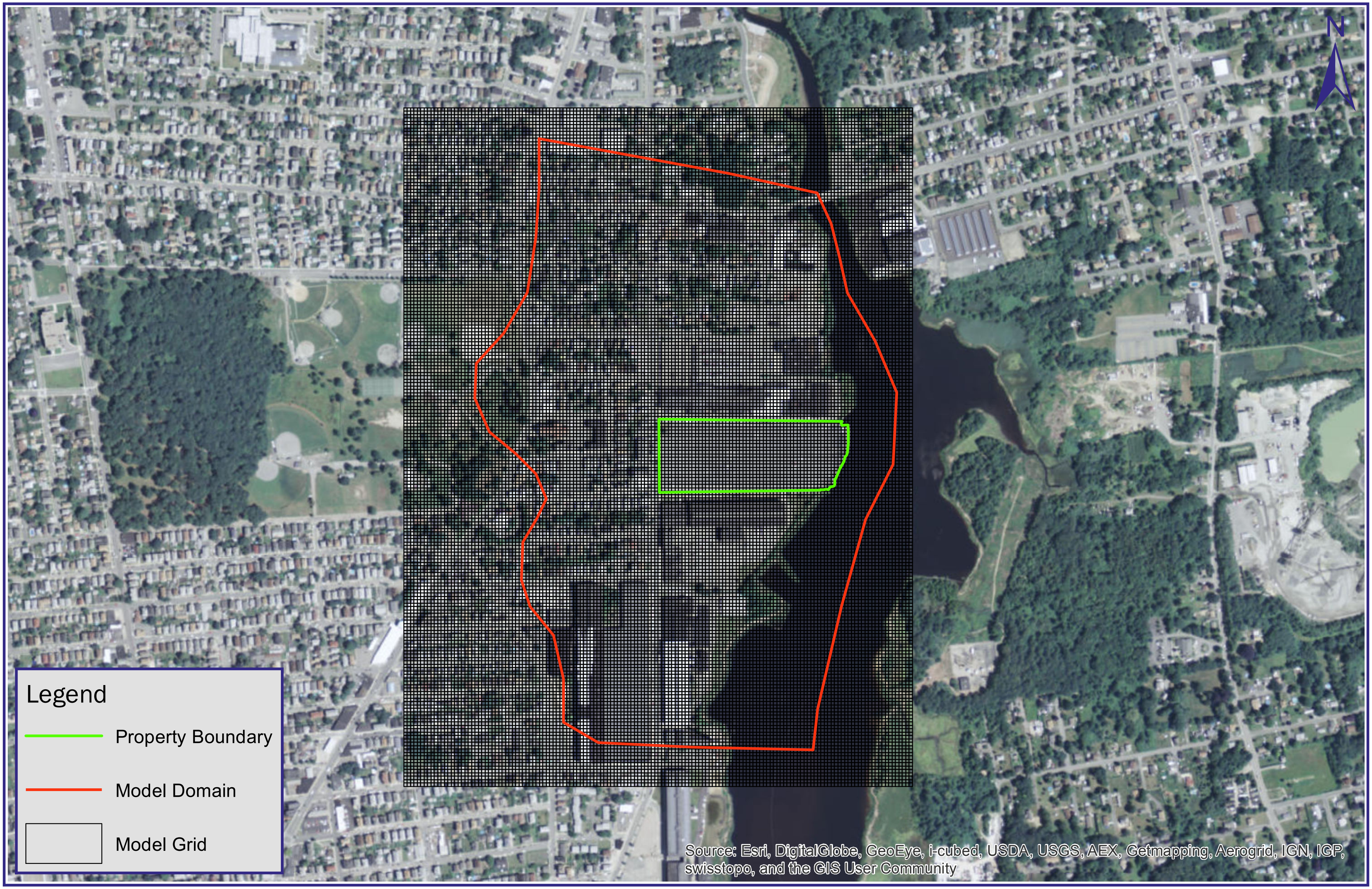
FIGURE 1-1
GROUNDWATER MODEL DOMAIN
FORMER AEROVOX FACILITY, NEW BEDFORD, MA



7/28/2016

Author: CMeyn Path: P:\GIS\AVX\Model_Grid.mxd

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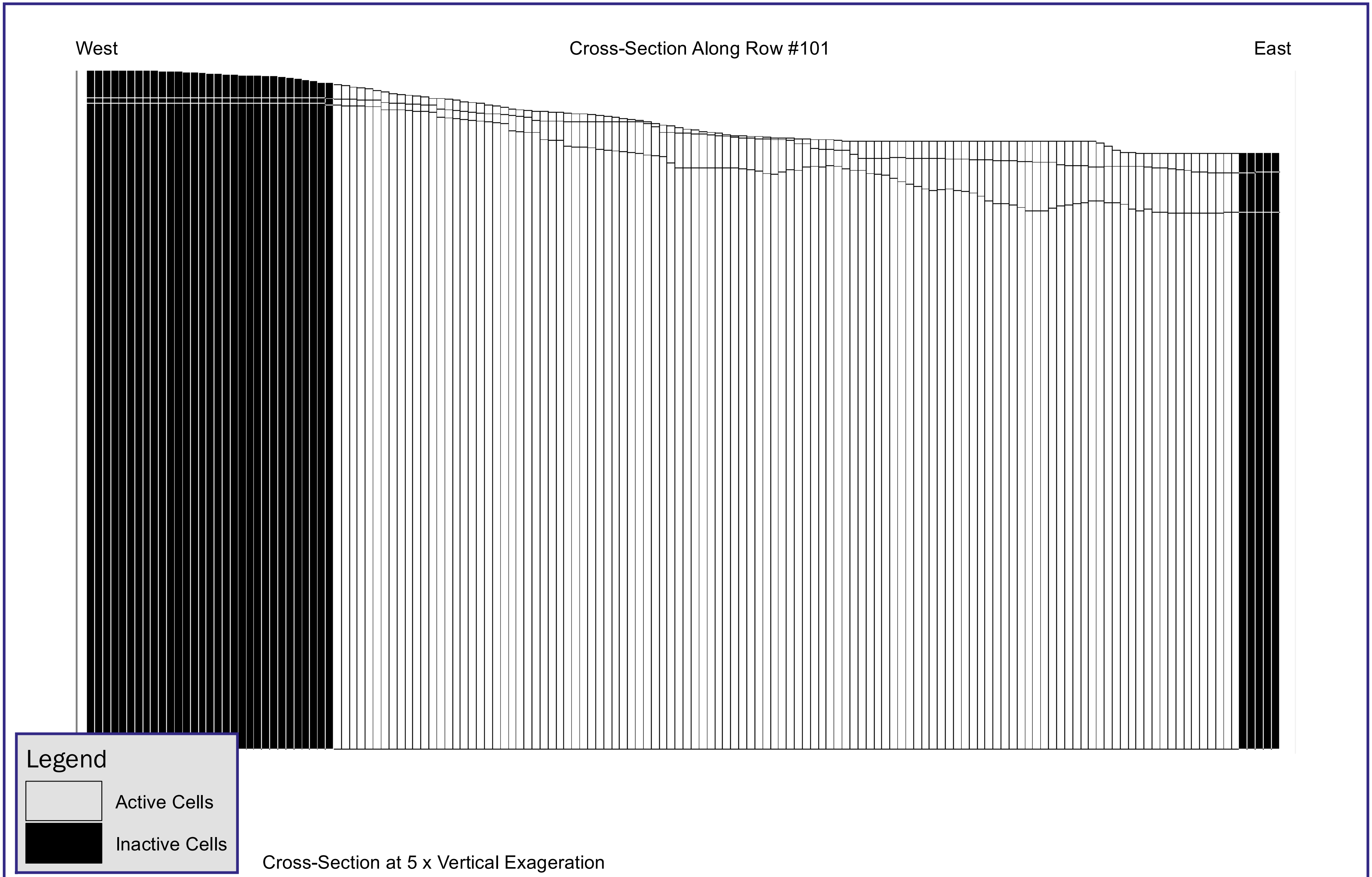
FIGURE 1-2
GROUNDWATER MODEL GRID
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

0 400 800
Feet

7/28/2016

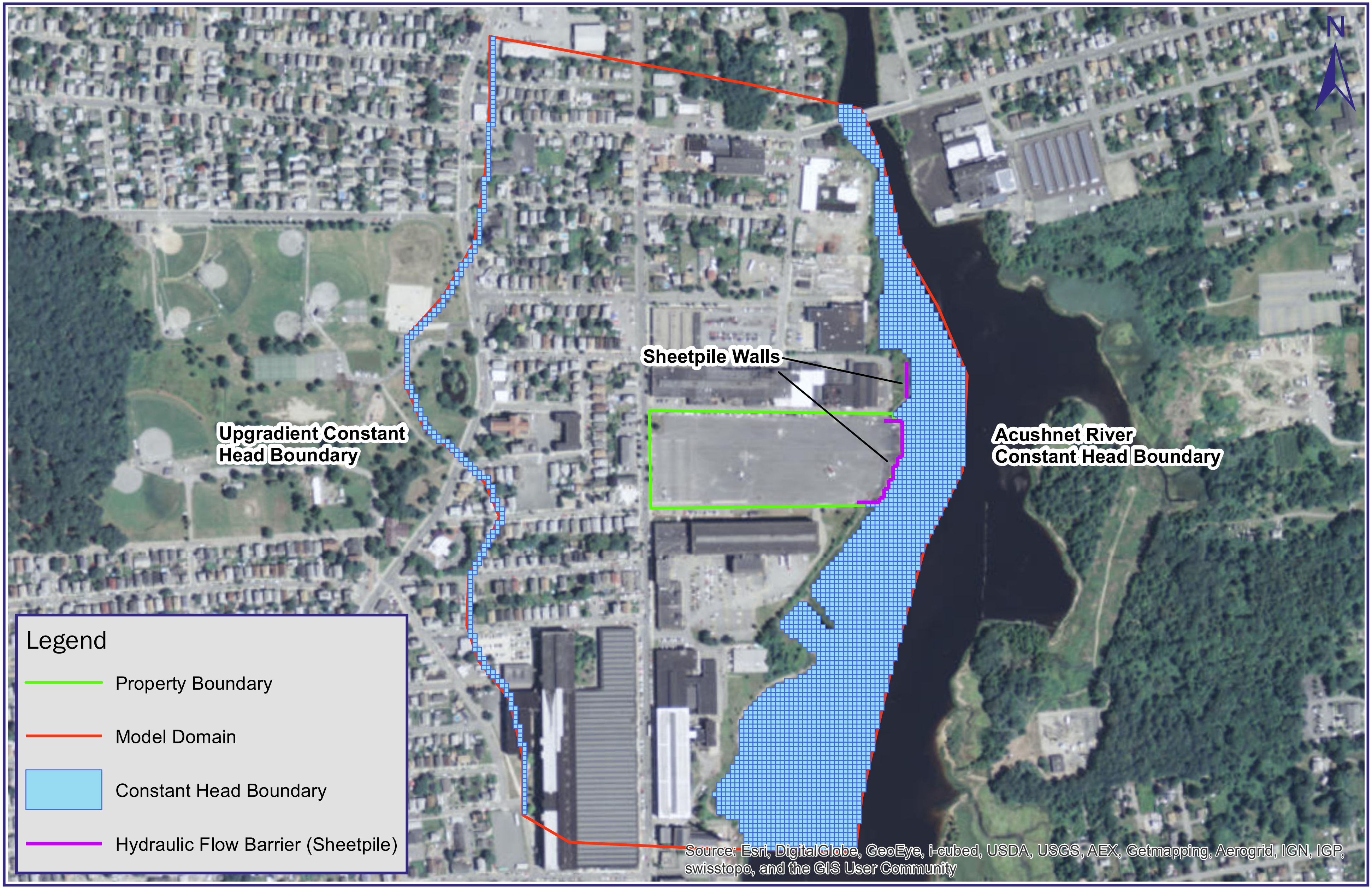


Author: CMeyn Path: P:\GIS\AVX\Grid_XSection.mxd

Brown AND Caldwell

FIGURE 1-3
GROUNDWATER MODEL GRID - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Boundary_Conditions.mxd

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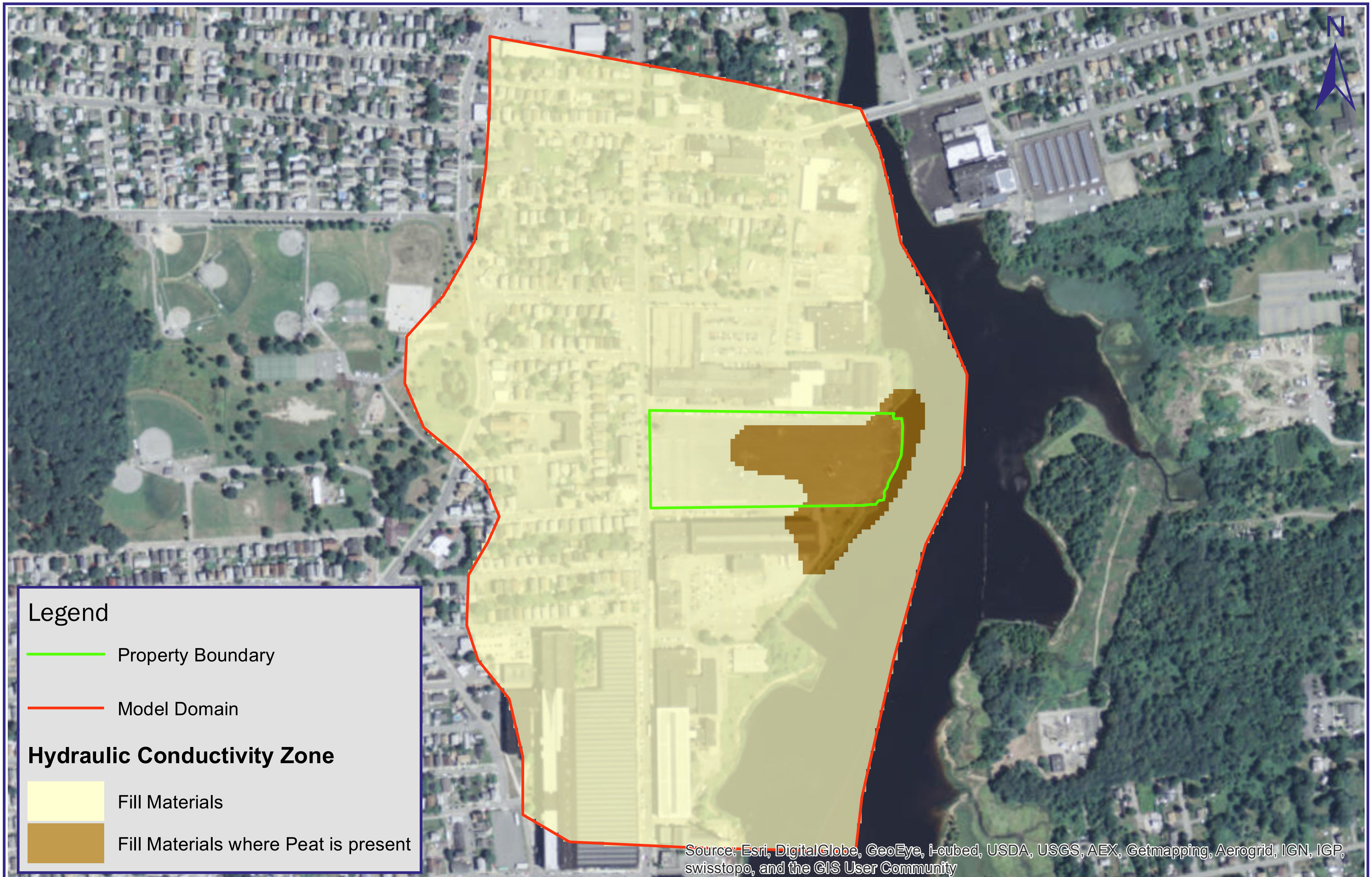
FIGURE 1-4
GROUNDWATER MODEL BOUNDARY CONDITIONS
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

0 300 600
Feet

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Hydraulic_Props_Layer1.mxd

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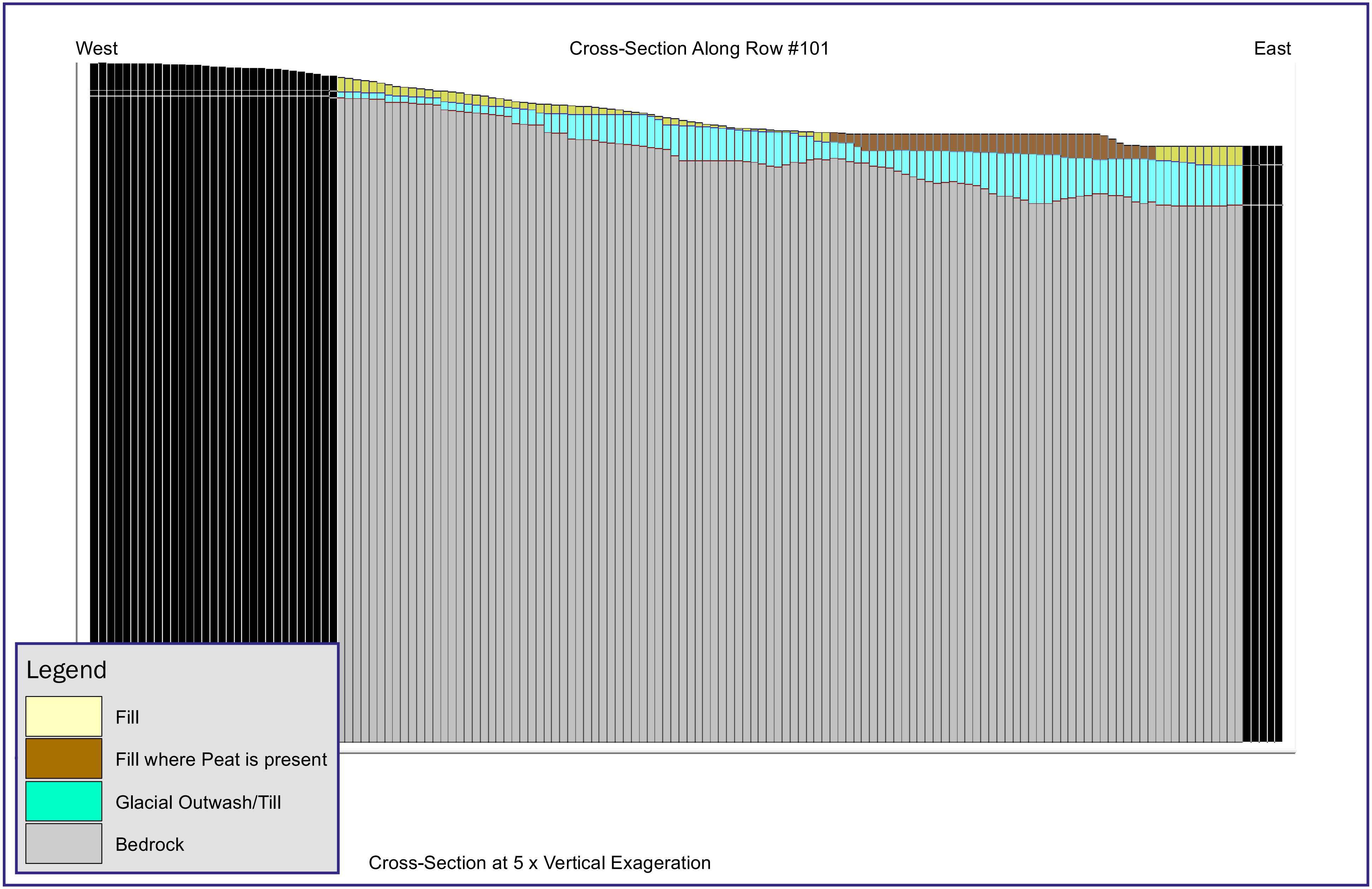
FIGURE 1-5
HYDRAULIC PROPERTIES, LAYER 1
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

0 300 600
Feet

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Hydraulic_Prop_XSection.mxd

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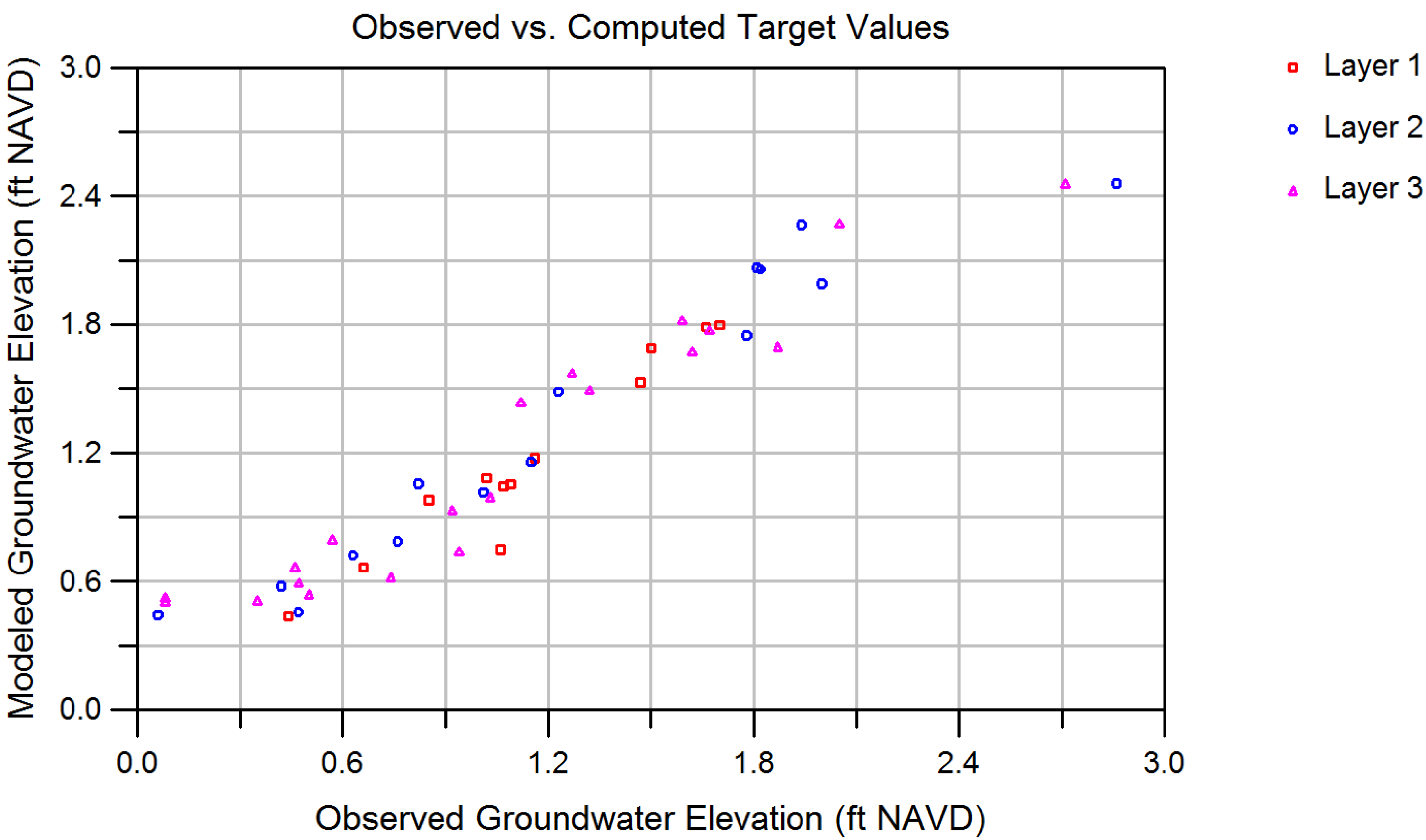
FIGURE 1-6
HYDRAULIC PROPERIES - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Calibration.mxd

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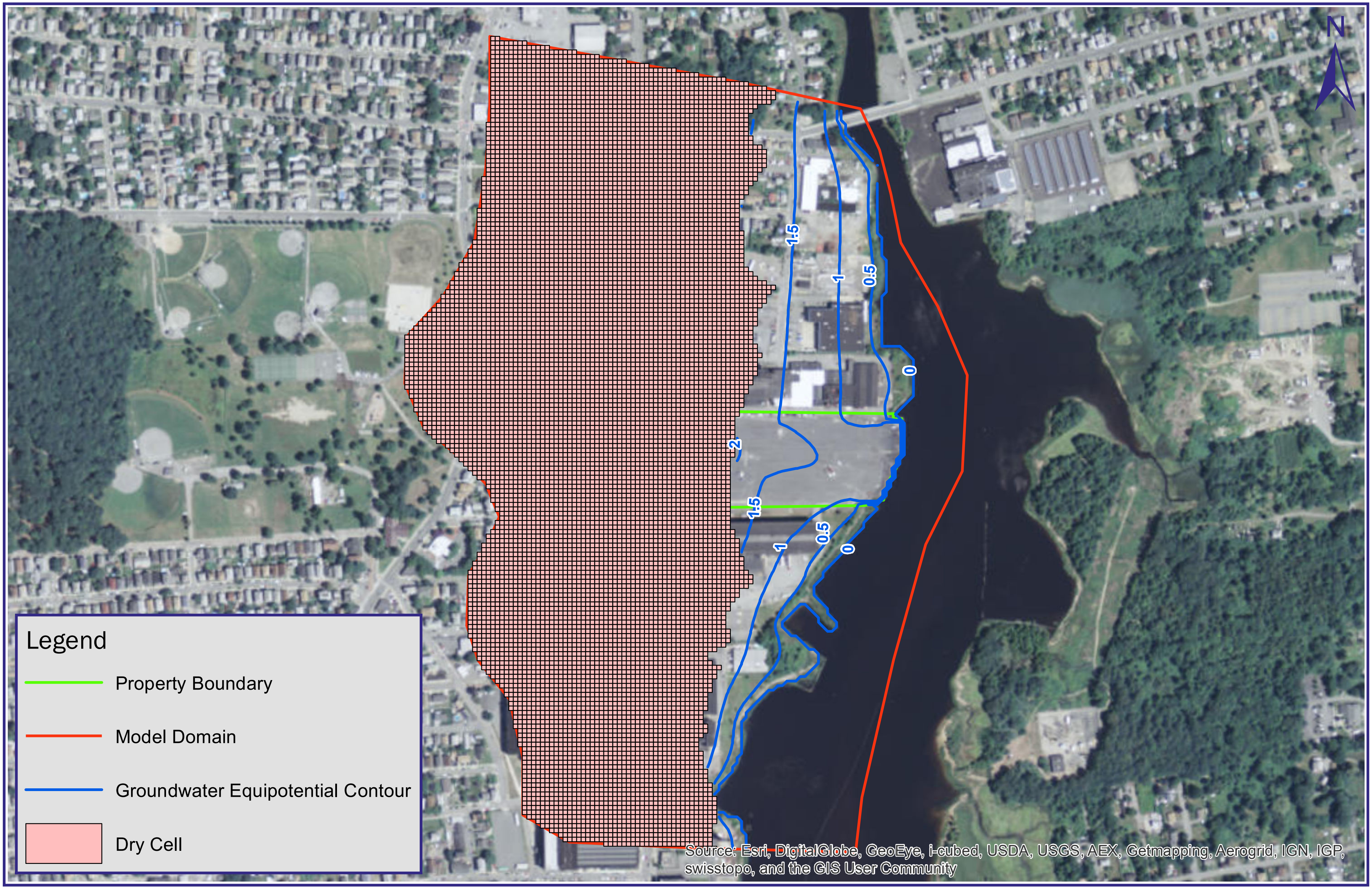
FIGURE 1-7
STEADY-STATE MODEL CALIBRATION RESULTS
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Calibrated_Layer1.mxd

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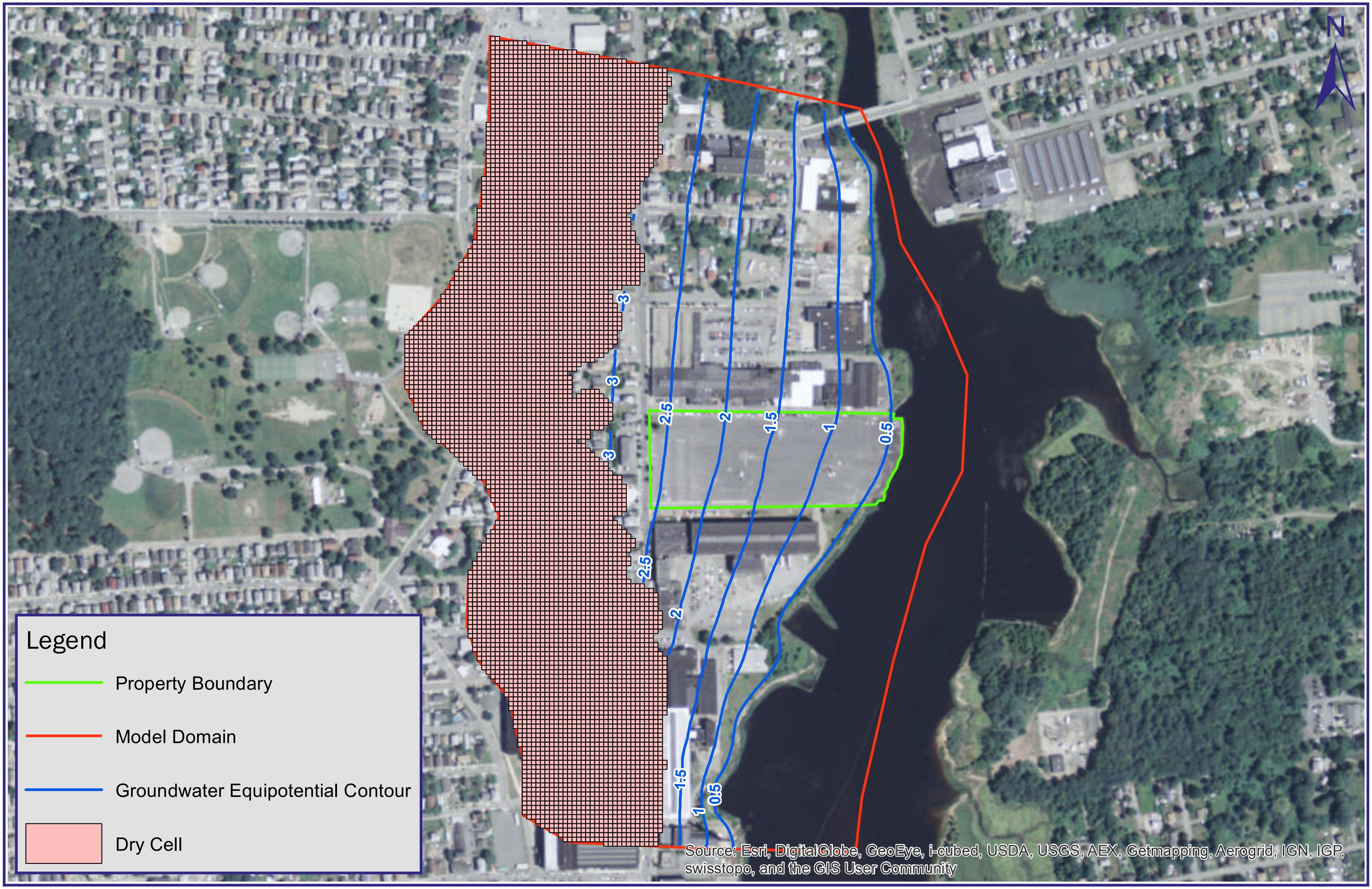
FIGURE 1-8
CALIBRATED GROUNDWATER EQUIPOTENTIAL CONTOURS - LAYER 1
FORMER AEROVOX FACILITY, NEW BEDFORD, MA



Author: CMeyn Path: P:\GIS\AVX\Calibrated_Layer2.mxd

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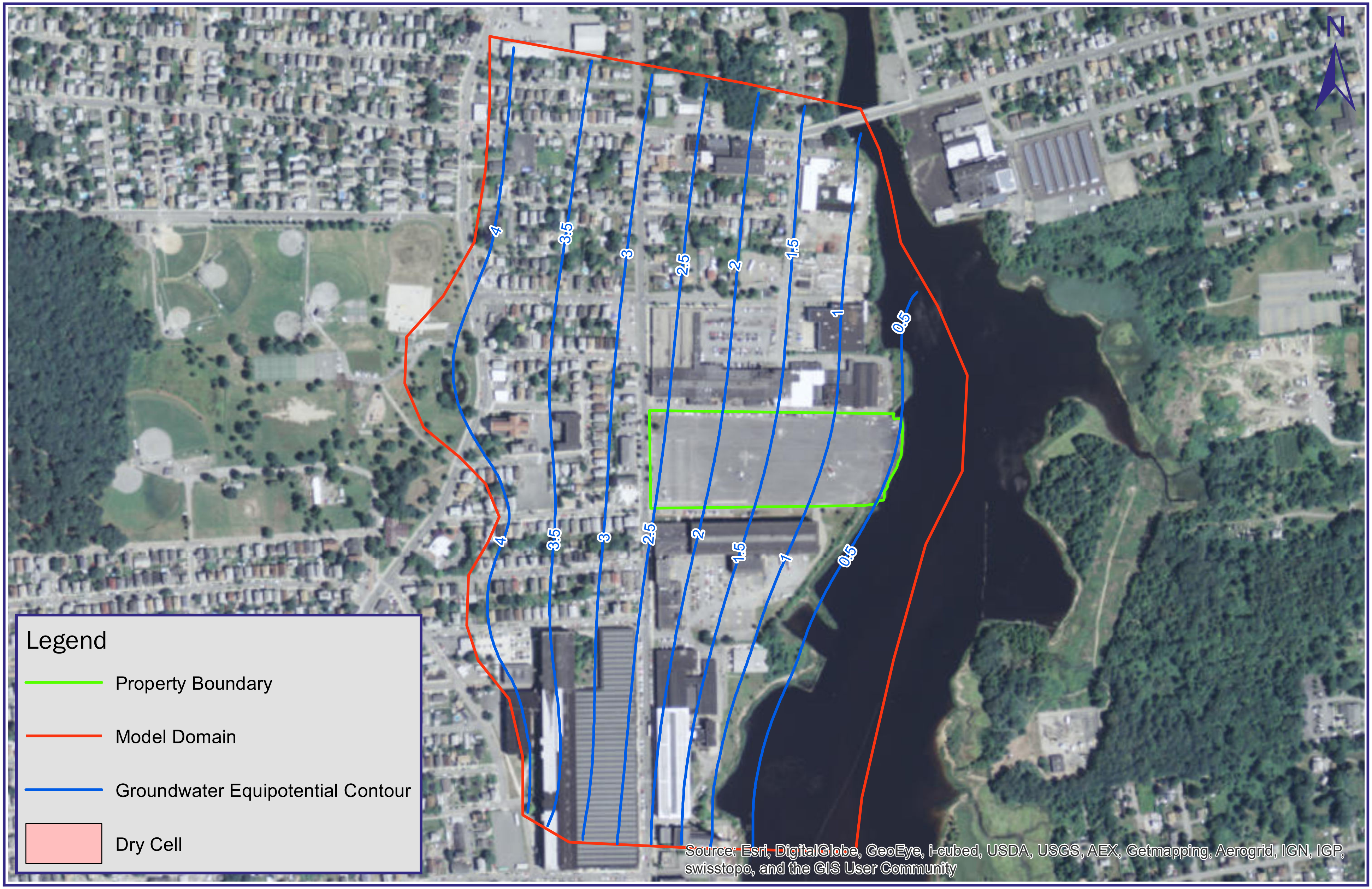
FIGURE 1-9
CALIBRATED GROUNDWATER EQUIPOTENTIAL CONTOURS - LAYER 2
FORMER AEROVOX FACILITY, NEW BEDFORD, MA



7/28/2016

Author: CMeyn Path: P:\GIS\AVX\Calibrated_Layer3.mxd

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FIGURE 1-10
CALIBRATED GROUNDWATER EQUIPOTENTIAL CONTOURS - LAYER 3
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

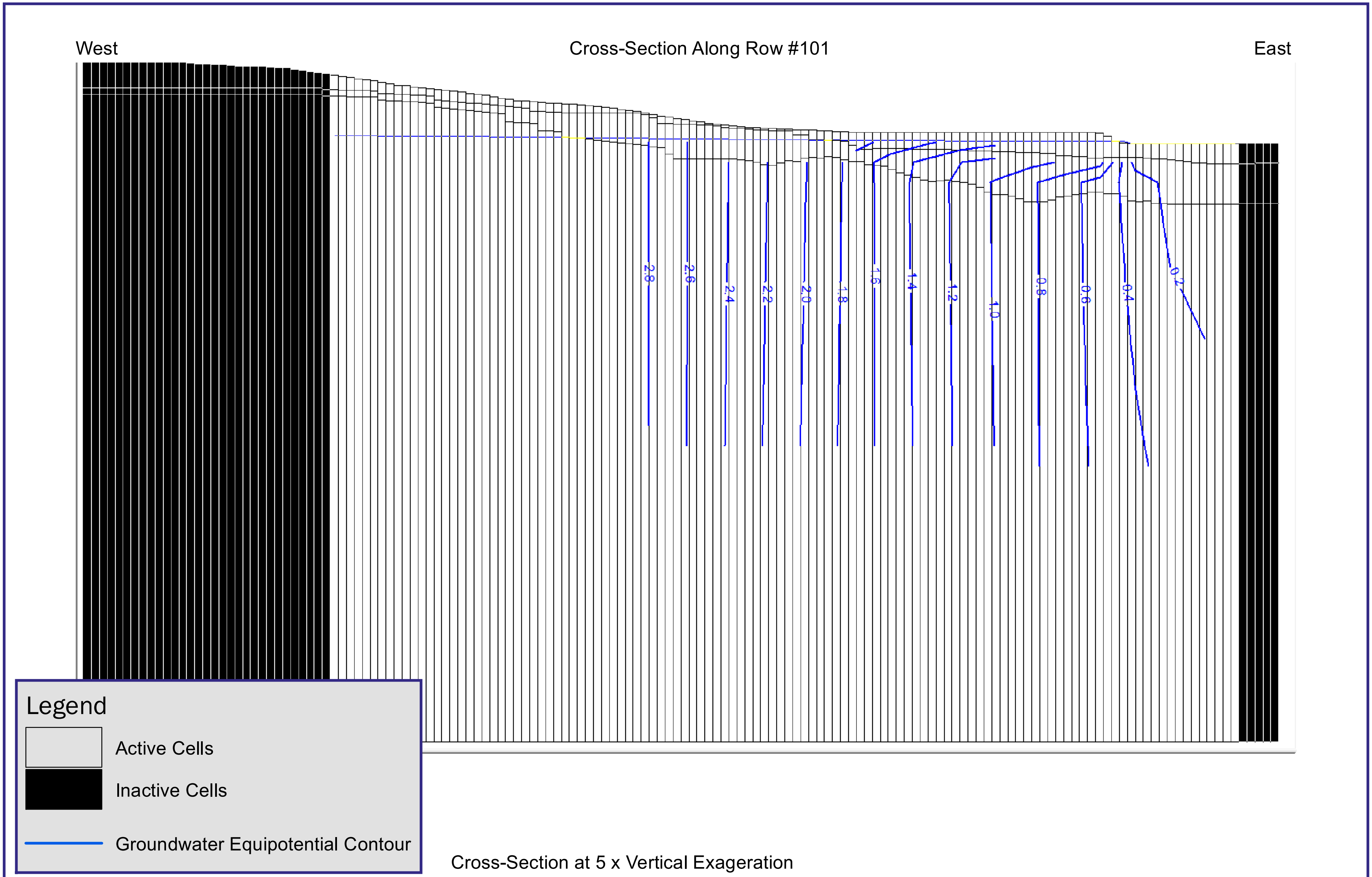

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FIGURE 1-11
CALIBRATED GROUNDWATER EQUIPOTENTIAL CONTOURS - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016

Author: CMeyn Path: P:\GIS\AVX\Scenario1_Layout.mxd

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FIGURE 2-1
REMEDIAL SCENARIO 1 LAYOUT
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

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Author: CMeyn Path: P:\GIS\AVX\Scenario1_Low_Tide.mxd

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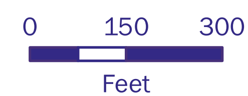
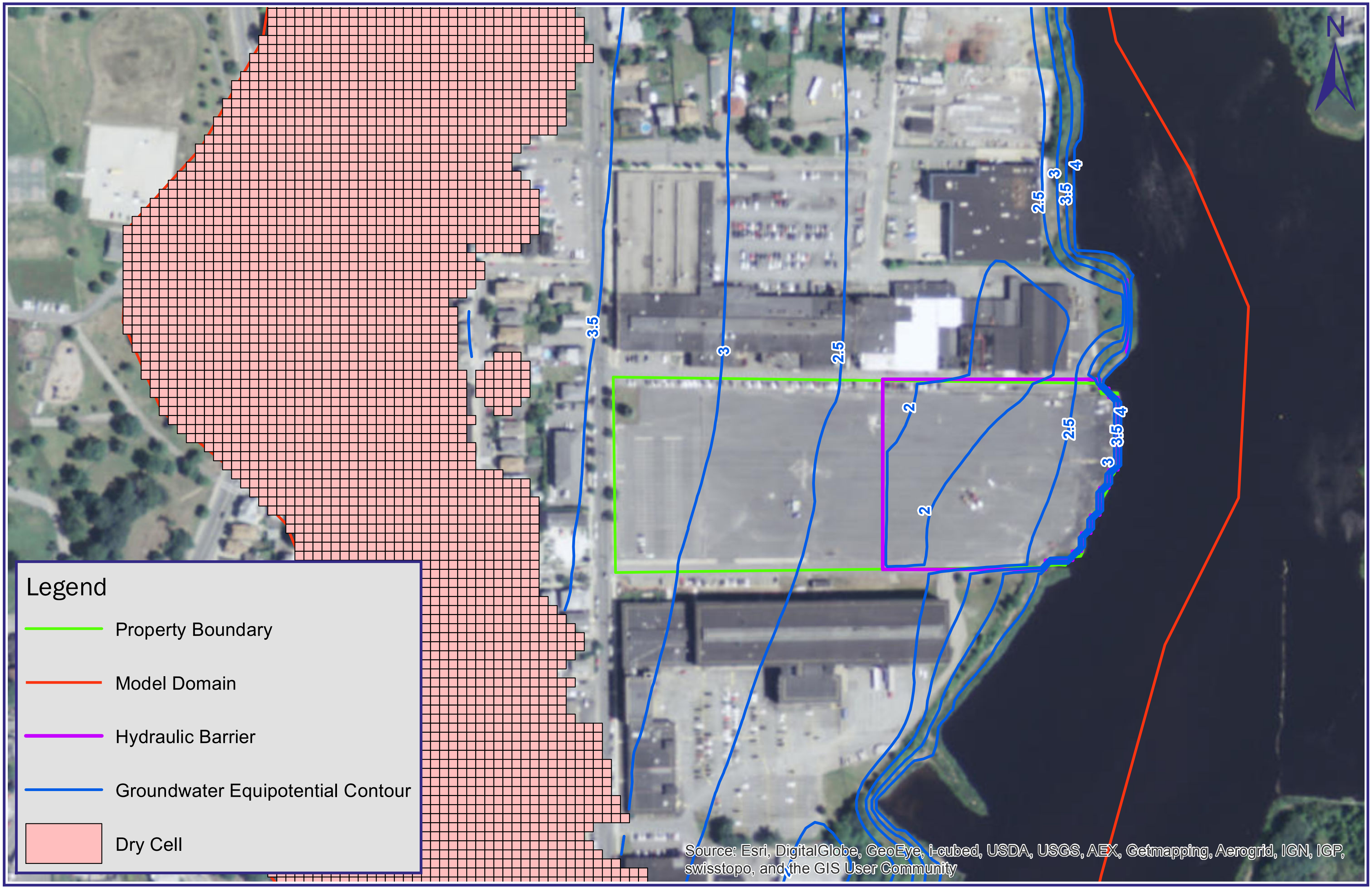
FIGURE 2-2
REMEDIAL SCENARIO 1 RESULTS AT LOW TIDE - LAYER 2
FORMER AEROVOX FACILITY, NEW BEDFORD, MA



7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Scenario1_High_Tide.mxd

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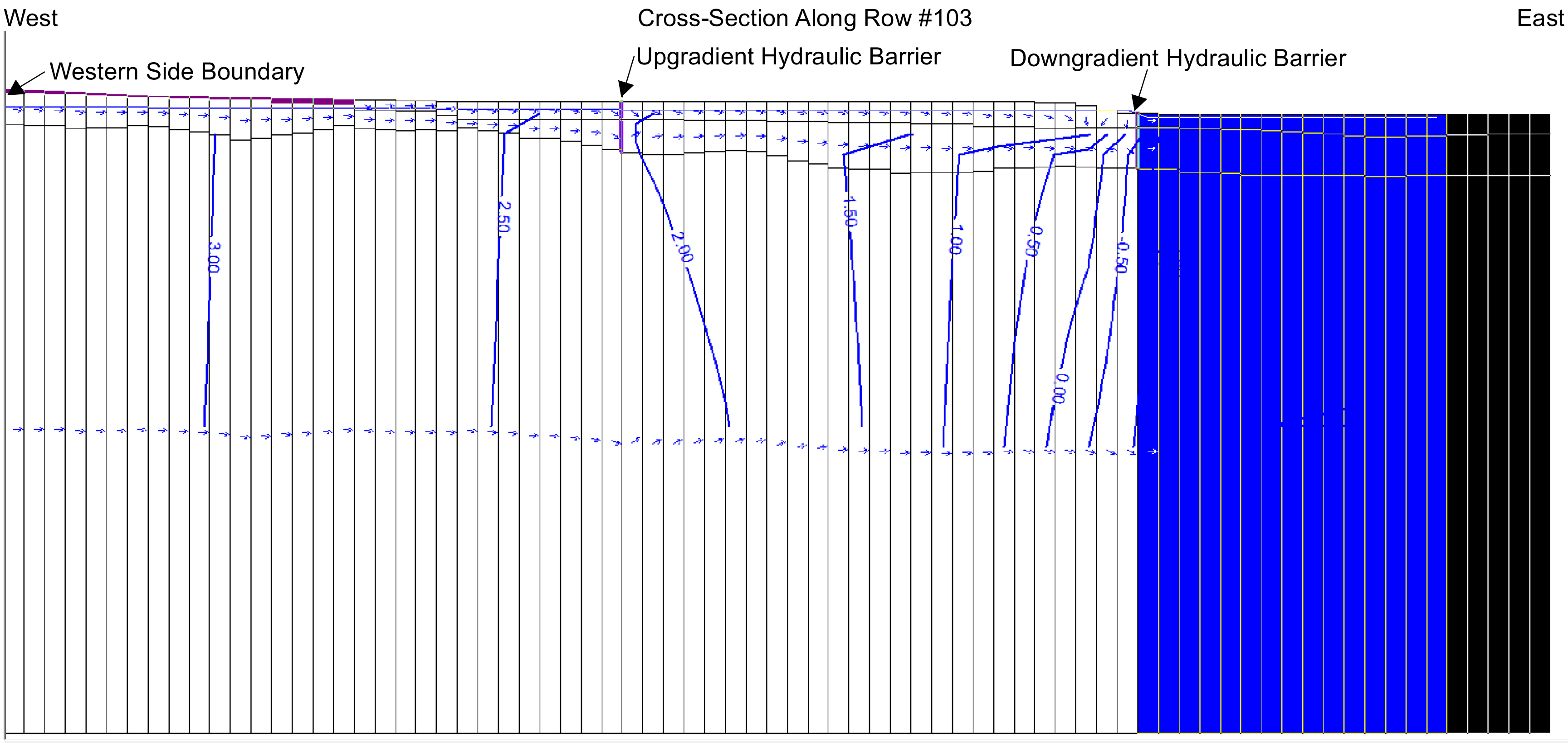
FIGURE 2-3
REMEDIAL SCENARIO 1 RESULTS AT HIGH TIDE - LAYER 2
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Legend

- Groundwater Equipotential Contour (Arrows Indicate Flow Direction)
- Constant Head Boundary
- Hydraulic Barrier
- Dry Cell

Cross-Section at 2 x Vertical Exageration

Author: CMeyn Path: P:\GIS\AVX\Scenario1_Low_Tide_XSection.mxd

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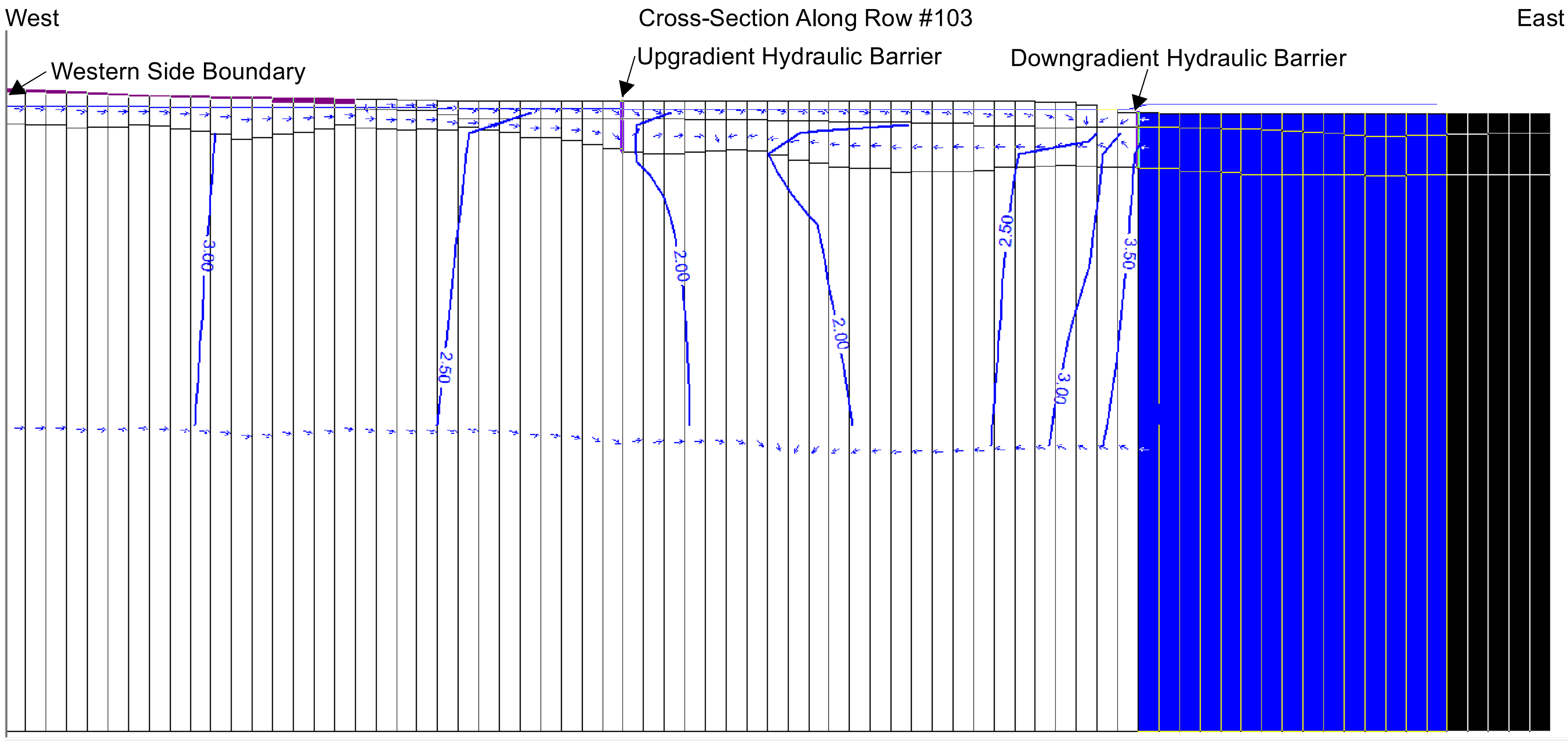
FIGURE 2-4
REMEDIAL SCENARIO 1 RESULTS AT LOW TIDE - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA



Legend

- Groundwater Equipotential Contour (Arrows Indicate Flow Direction)
- Constant Head Boundary
- Hydraulic Barrier
- Dry Cell

Cross-Section at 2 x Vertical Exageration

Author: CMeyn Path: P:\GIS\AVX\Scenario1_High_Tide_XSection.mxd

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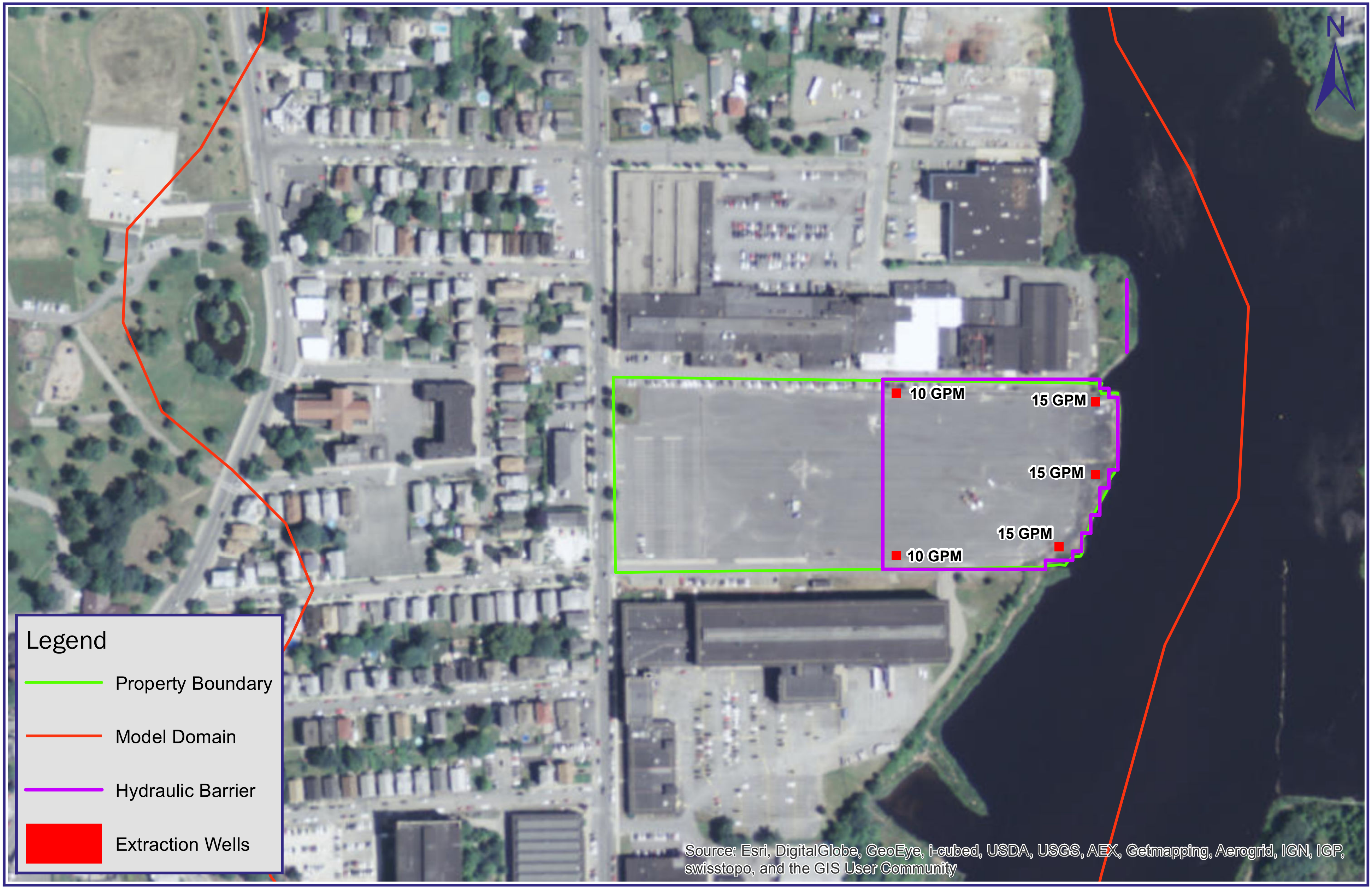
FIGURE 2-5
REMEDIAL SCENARIO 1 RESULTS AT HIGH TIDE - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Scenario2_Layout.mxd

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FIGURE 2-6
REMEDIAL SCENARIO 2 LAYOUT
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

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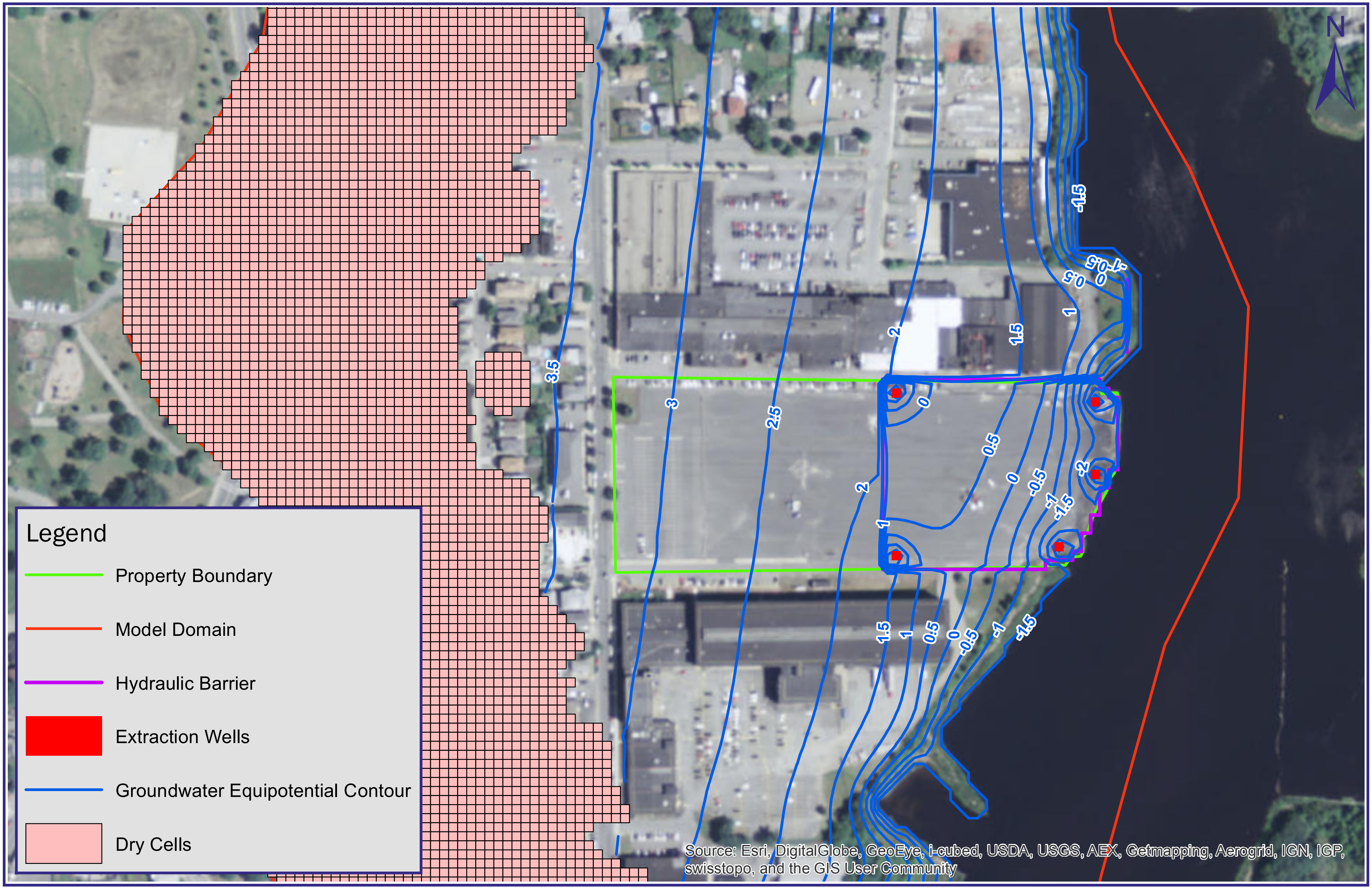

Author: CMeyn Path: P:\GIS\AVX\Scenario2_Low_Tide.mxd

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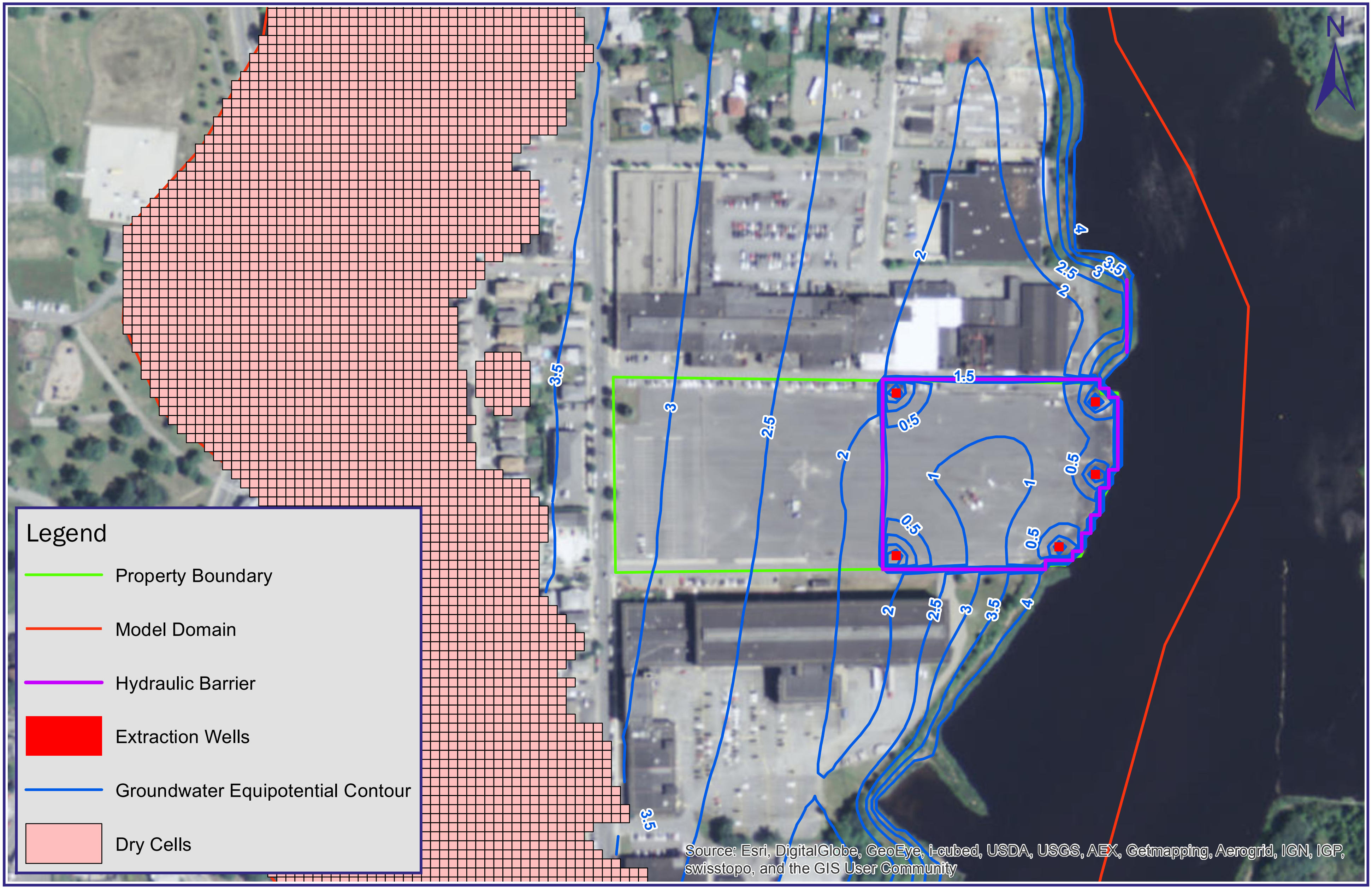
FIGURE 2-7
REMEDIAL SCENARIO 2 RESULTS AT LOW TIDE - LAYER 2
FORMER AEROVOX FACILITY, NEW BEDFORD, MA



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Author: CMeyn Path: P:\GIS\AVX\Scenario2_High_Tide.mxd

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FIGURE 2-8
REMEDIAL SCENARIO 2 RESULTS AT HIGH TIDE - LAYER 2
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

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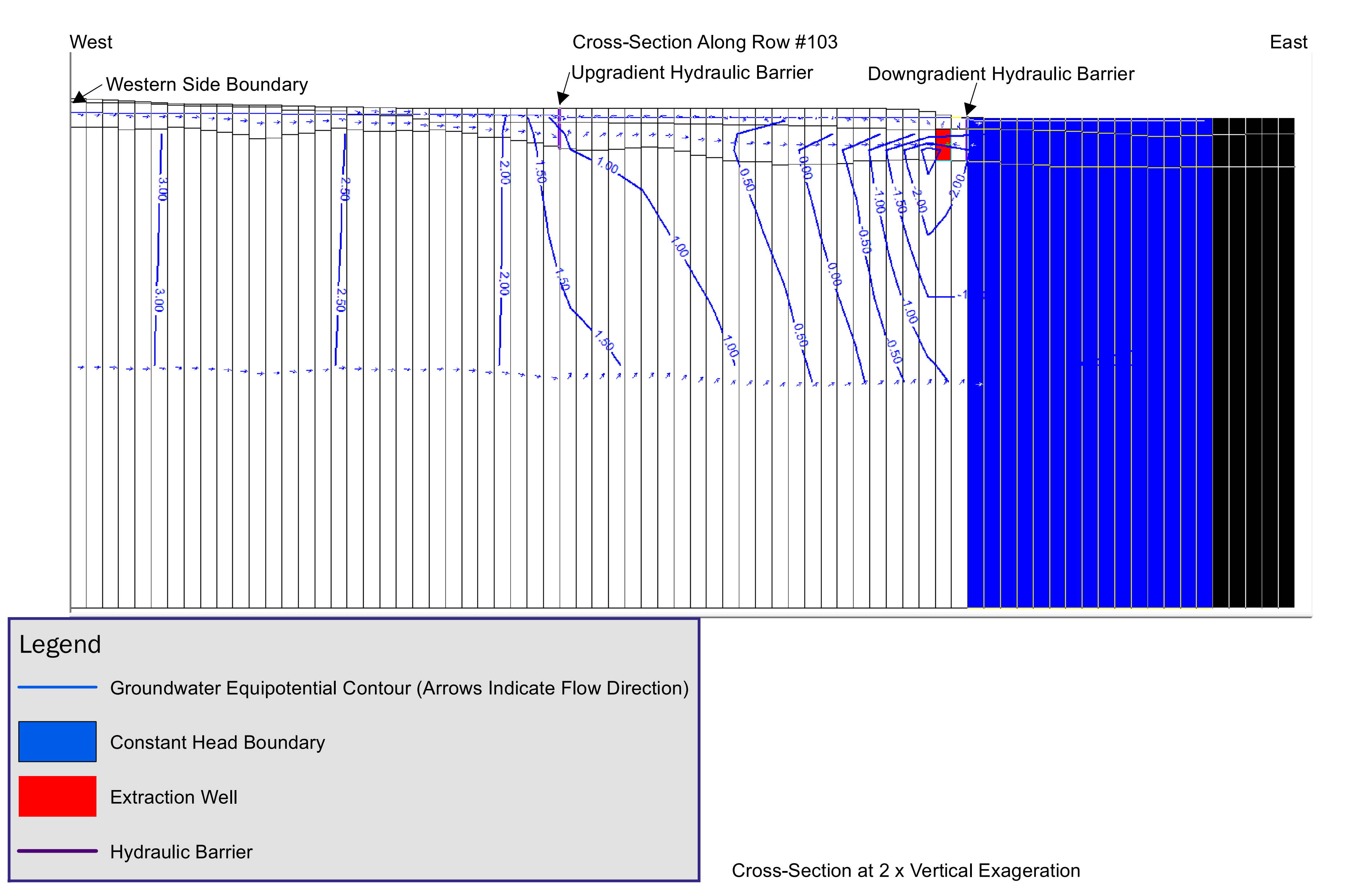

Author: CMeyn Path: P:\GIS\AVX\Scenario2_Low_Tide_XSection.mxd

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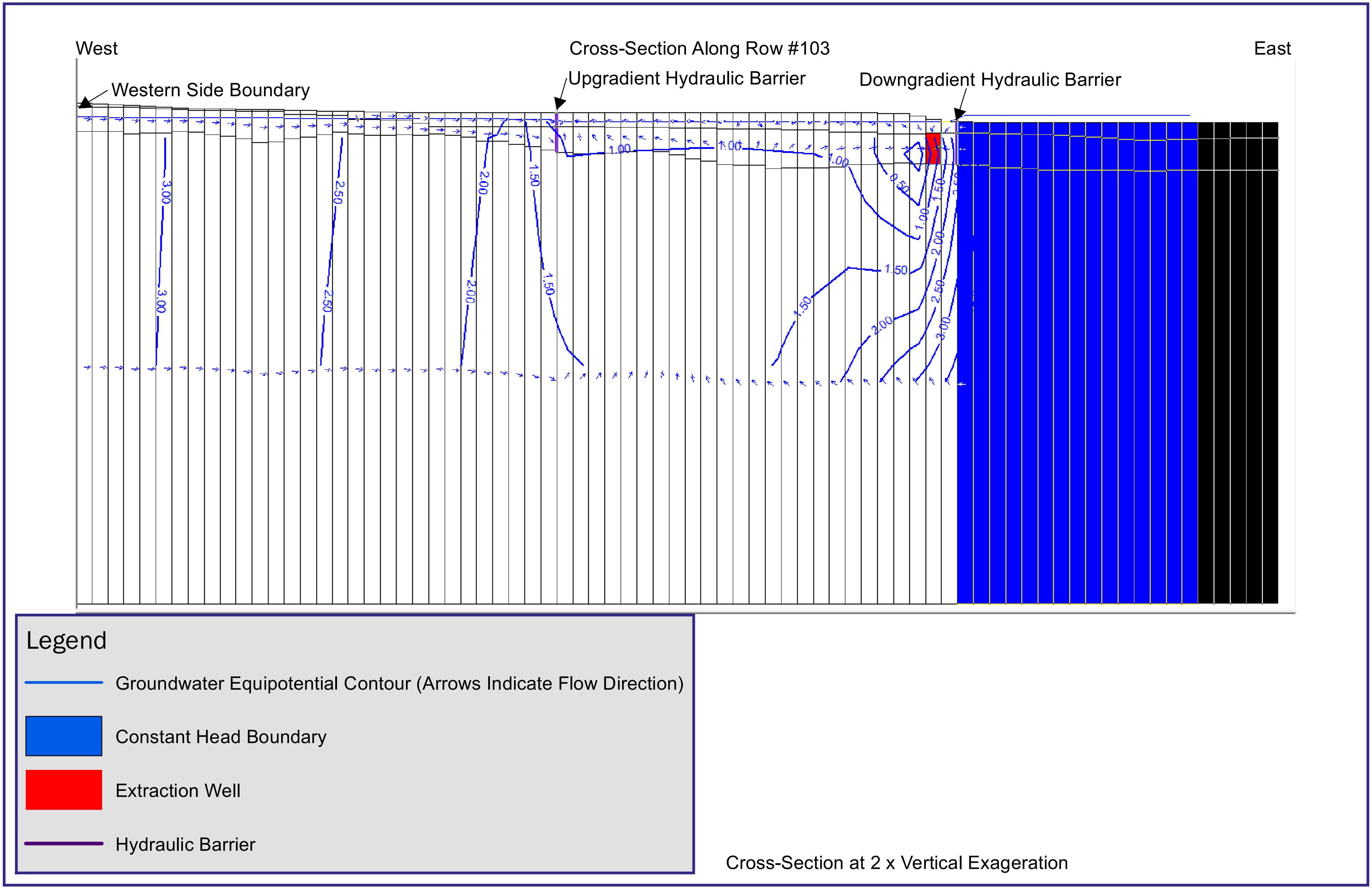
FIGURE 2-9
REMEDIAL SCENARIO 2 RESULTS AT LOW TIDE - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Scenario2_High_Tide_XSection.mxd

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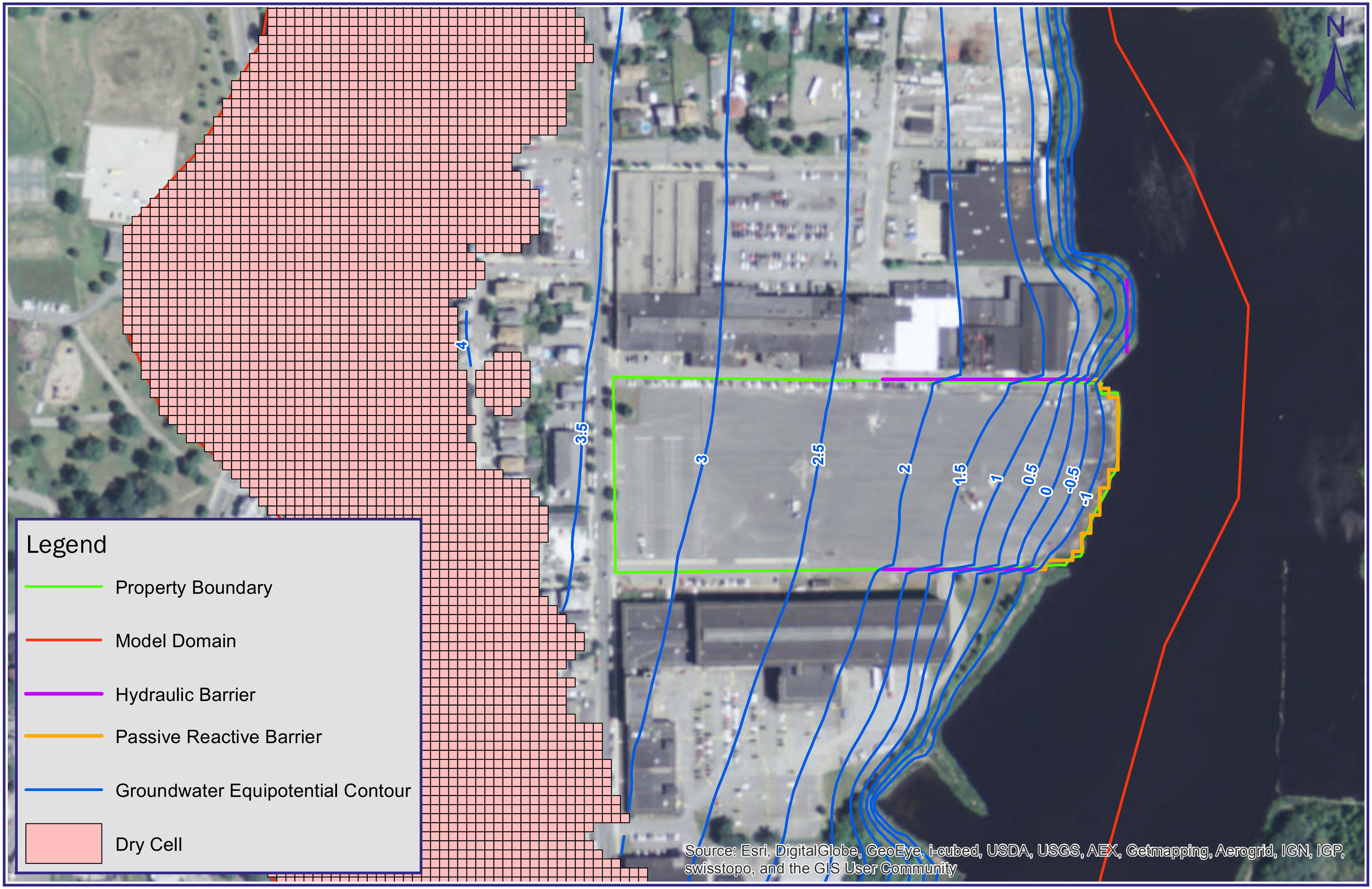
FIGURE 2-10
REMEDIAL SCENARIO 2 RESULTS AT HIGH TIDE - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

Author: CMeyn Path: P:\GIS\AVX\Scenario3_Layout.mxd

Brown AND Caldwell

FIGURE 2-11
REMEDIAL SCENARIO 3 LAYOUT
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

0 150 300
Feet



Author: CMeyn Path: P:\GIS\AVX\Scenario3_Lowtide.mxd

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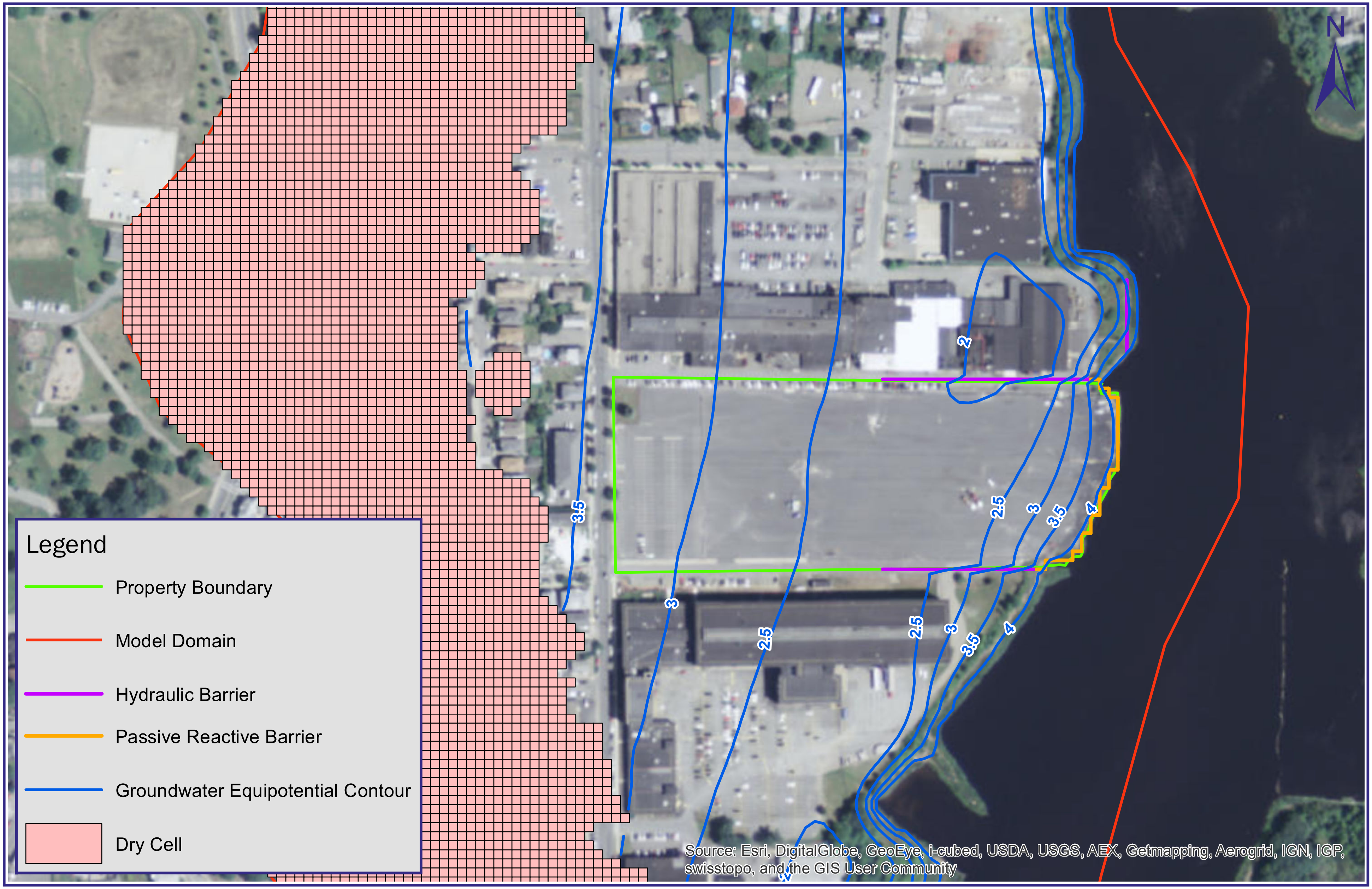
FIGURE 2-12
REMEDIAL SCENARIO 3 RESULTS AT LOW TIDE - LAYER 2
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Author: CMeyn Path: P:\GIS\AVX\Scenario3_Hightide.mxd

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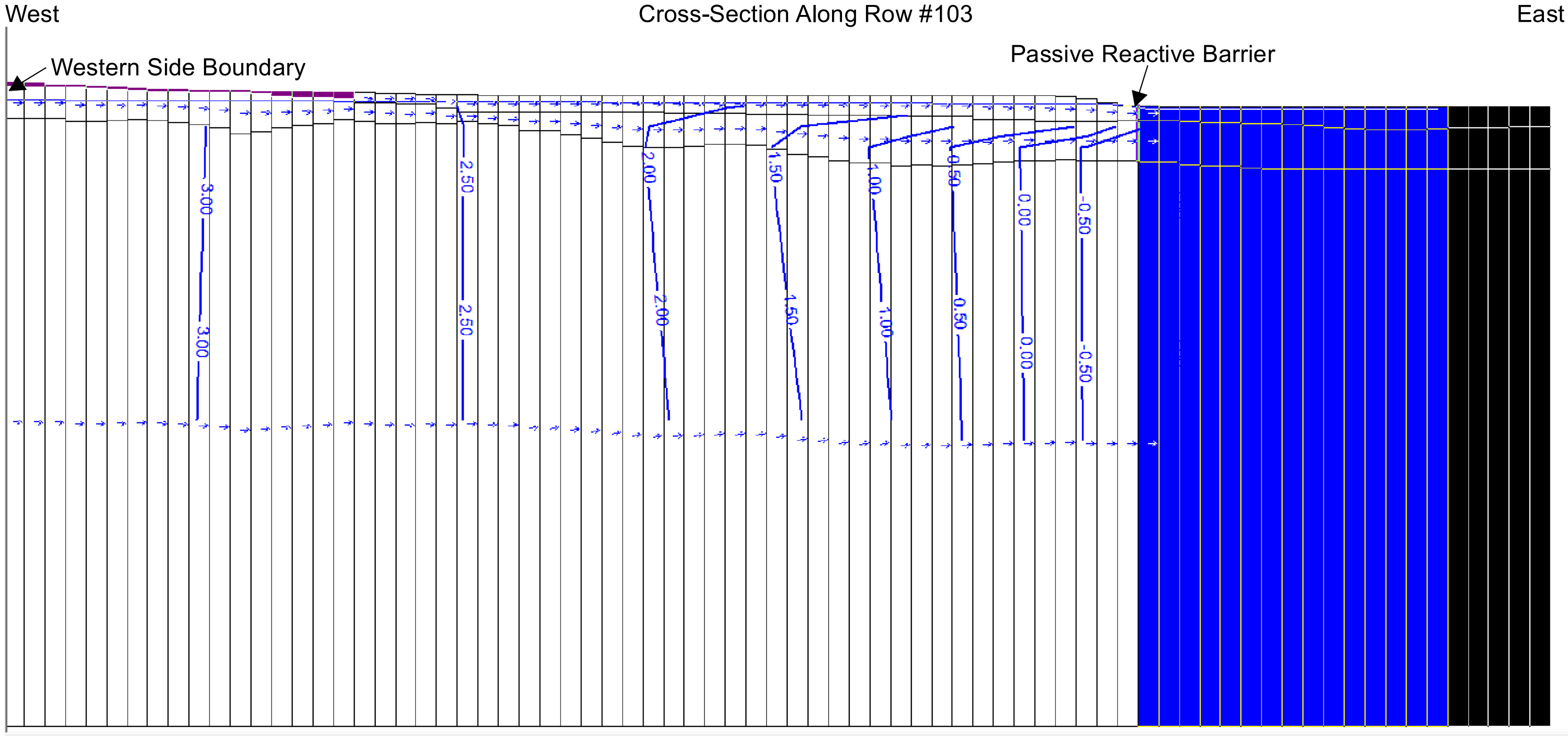
FIGURE 2-13
REMEDIAL SCENARIO 3 RESULTS AT HIGH TIDE - LAYER 2
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

7/28/2016



Legend

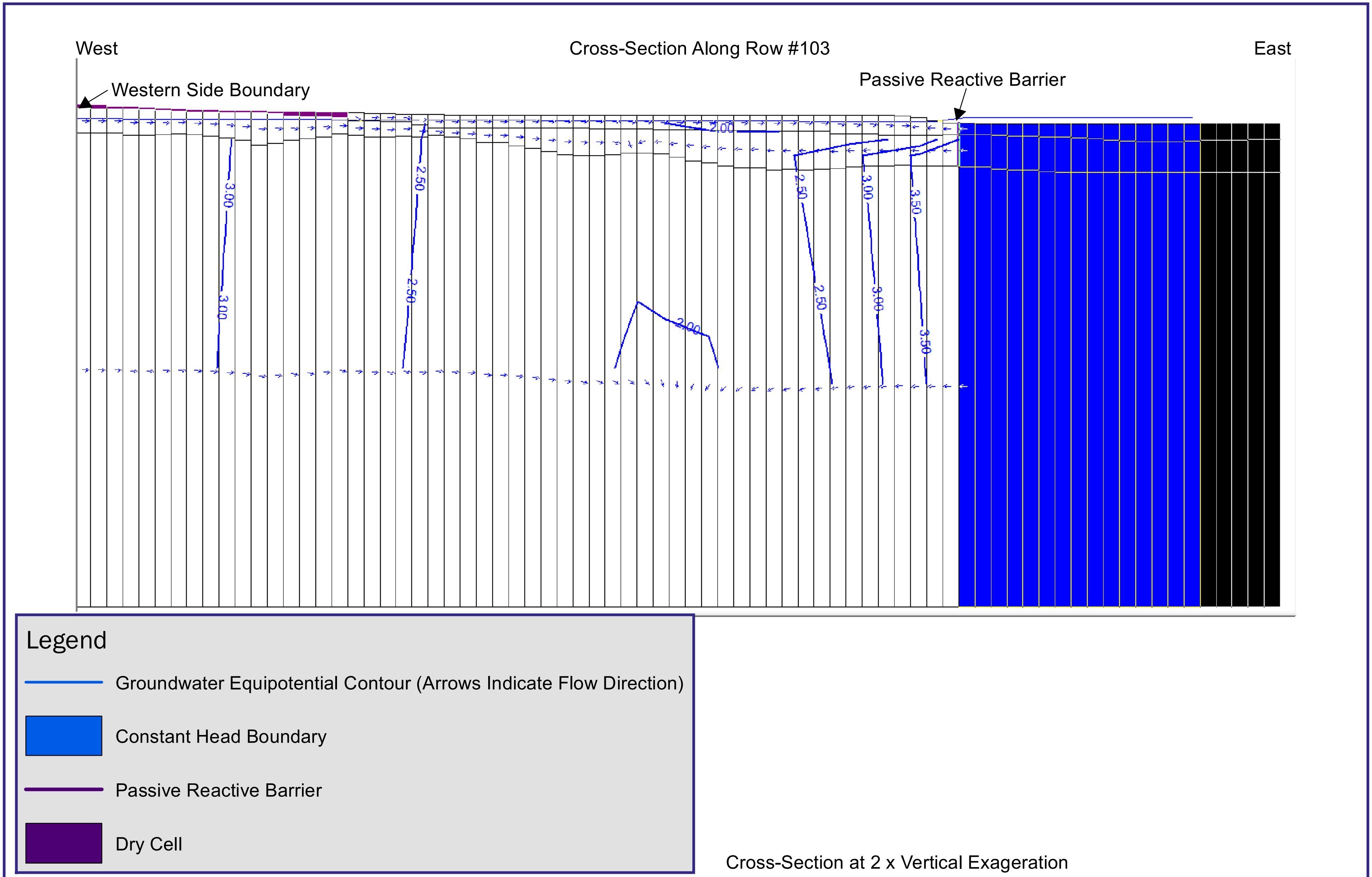
- Groundwater Equipotential Contour (Arrows Indicate Flow Direction)
- Constant Head Boundary
- Passive Reactive Barrier
- Dry Cell

Cross-Section at 2 x Vertical Exageration

Author: CMeyn Path: P:\GIS\AVX\Scenario3_Low_Tide_XSection.mxd

Brown AND Caldwell

FIGURE 2-14
REMEDIAL SCENARIO 3 RESULTS AT LOW TIDE - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA



7/28/2016

Author: CMeyn Path: P:\GIS\AVX\Scenario3_High_Tide_XSection.mxd

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FIGURE 2-15
REMEDIAL SCENARIO 3 RESULTS AT HIGH TIDE - CROSS-SECTION
FORMER AEROVOX FACILITY, NEW BEDFORD, MA

Appendix D: Cost Estimates

Alternative 1

Removal of PCB Impacted Soils in Upper Two Feet (> 1 mg/kg) and At Depth (> 100 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$30,000	$30,000
2	SITE PREPARATION	1	LS	$33,000	$33,000
3	TEMPORARY FACILITIES AND CONTROLS	3	MONTH	$22,000	$66,000
4	SOIL EXCAVATION				
	a. Soil with PCB concentrations < 50 mg/kg	700	CY	$20	$14,000
	b. Soil with PCB concentrations > 50 mg/kg	5,900	CY	$20	$118,000
5	TRANSPORTATION AND DISPOSAL OF EXCAVATED SOILS				
	a. Soils with PCB concentrations < 50 mg/kg	1,100	TON	$85	$94,000
	b. Soils with PCB concentrations > 50 mg/kg	9,400	TON	$275	$2,585,000
6	SITE RESTORATION				
	a. Imported Clean Backfill	6,600	CY	$40	$264,000
	b. Cap Installation (demarcation layer, vegetative cover)	4,350	SY	$4.75	$21,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$3,230,000
7	CONTINGENCY:				
	a. 25% of Non-Transportation and Disposal Cost	25	%	$129,000	$129,000
	b. 10% of Transportation and Disposal Cost	10	%	$268,000	$268,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$3,700,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
8	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$90,000	$90,000
	b. Design and Contractor Procurement	1	LS	$100,000	$100,000
9	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$120,000	$120,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
10	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$350,000
11	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$88,000	$88,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$438,000**
	TOTAL CAPITAL COST:				**$4,200,000**

Alternative 1

Removal of PCB Impacted Soils in Upper Two Feet (> 1 mg/kg) and At Depth (> 100 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
12	Operation and Maintenance				
	a. Soil Cap Monitoring and Documentation	1	LS	$5,000	$5,000
	b. Soil Cap Maintenance and Repairs	1	LS	$2,000	$2,000
	Item Subtotal (Annual O&M)				$7,000
13	CONTINGENCY: (25% of O&M annual cost)	25	%	$2,000	$2,000
	TOTAL ANNUAL O&M COST:				**$9,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$177,000**	**$4,400,000**

Alternative 2

Removal of PCB Impacted Soils at Concentrations Greater Than Commerical/Industrial Risk Based Concentration (4 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$30,000	$30,000
2	SITE PREPARATION	1	LS	$33,000	$33,000
3	TEMPORARY FACILITIES AND CONTROLS	3	MONTH	$22,000	$66,000
4	SOIL EXCAVATION				
	a. Soil with PCB concentration > 4 mg/kg	7,270	CY	$20	$145,000
	b. Excavation Shoring	9,500	SF	$50	$475,000
5	TRANSPORTATION AND DISPOSAL OF EXCAVATED SOILS				
	a. Soils with PCB concentrations > 4 mg/kg	430	TON	$85	$37,000
	b. Soils with PCB concentrations > 50 mg/kg	11,200	TON	$275	$3,080,000
6	SITE RESTORATION				
	a. Imported Clean Backfill	7,270	CY	$40	$291,000
	b. Cap Installation (demarcation layer, vegetative cover)	5,810	SY	$4.75	$28,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$4,190,000
7	CONTINGENCY: (25% of construction costs and 10% of T&D)				
	a. 25% of Non-Transportation and Disposal Cost	25	%	$260,000	$260,000
	b. 10% of Transportation and Disposal Cost	10	%	$312,000	$312,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$4,770,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
8	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$90,000	$90,000
	b. Design and Contractor Procurement	1	LS	$100,000	$100,000
9	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$120,000	$120,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
10	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$350,000
11	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$88,000	$88,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$438,000**
	TOTAL CAPITAL COST:				**$5,300,000**

Alternative 2

Removal of PCB Impacted Soils at Concentrations Greater Than Commerical/Industrial Risk Based Concentration (4 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
12	Operation and Maintenance				
	a. Soil Cap Monitoring and Documentation	1	LS	$5,000	$5,000
	b. Soil Cap Maintenance and Repairs	1	LS	$2,000	$2,000
	Item Subtotal (Annual O&M)				$7,000
13	CONTINGENCY: (25% of O&M annual cost)	25	%	$2,000	$2,000
	TOTAL ANNUAL O&M COST:				**$9,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$177,000**	**$5,500,000**

Alternative 3

Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$30,000	$30,000
2	SITE PREPARATION	1	LS	$33,000	$33,000
3	TEMPORARY FACILITIES & CONTROLS	3	MONTH	$22,000	$66,000
4	SOIL EXCAVATION				
	a. Soil with PCB concentrations > 1 mg/kg	9,350	CY	$20	$187,000
	b. Excavation Support	9,500	SF	$50	$475,000
5	TRANSPORTATION AND DISPOSAL OF EXCAVATED SOILS				
	a. Soils with PCB concentrations < 50 mg/kg	1,300	TON	$85	$111,000
	b. Soils with PCB concentrations > 50 mg/kg	13,660	TON	$275	$3,757,000
6	SITE RESTORATION				
	a. Imported Clean Backfill	9,350	CY	$40	$374,000
	b. Surface restoration (vegetative cover)	6,480	SY	$1.60	$10,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$5,040,000
7	CONTINGENCY: (25% of construction costs and 10% of T&D)				
	a. 25% of Non-Transportation and Disposal Cost	25	%	$286,000	$286,000
	b. 10% of Transportation and Disposal Cost	10	%	$387,000	$387,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$5,800,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
8	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$90,000	$90,000
	b. Design and Contractor Procurement	1	LS	$100,000	$100,000
9	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$120,000	$120,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
10	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$330,000
11	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$83,000	$83,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$413,000**
	TOTAL CAPITAL COST:				**$6,300,000**

Alternative 3

Removal of PCB Impacted Soils at Concentrations Greater than Unrestricted Use Risk Based Concentration (1 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
12	NOT REQUIRED			$0	
	Item Subtotal (Annual O&M)				$0
13	CONTINGENCY: (25% of O&M annual cost)	25	%	$0	$0
	TOTAL ANNUAL O&M COST:				**$0**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$0**	**$6,300,000**

Alternative 4

PCB Impacted Soils Addressed with Asphalt Cap
(> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$25,000	$25,000
2	SITE PREPARATION	1	LS	$33,000	$33,000
3	TEMPORARY FACILITIES AND CONTROLS	1	MONTH	$8,000	$8,000
4	SOIL EXCAVATION				
	a. Excavate Soils to Accommodate Remedial Cap	0	CY	$20	$0
5	TRANSPORTATION AND DISPOSAL OF EXCAVATED SOILS				
	a. Soils with PCB concentrations < 50 mg/kg	0	TON	$85	$0
	b. Soils with PCB concentrations > 50 mg/kg	0	TON	$275	$0
6	SITE RESTORATION				
	a. Imported Clean Backfill Subbase	1,100	CY	$40	$44,000
	b. Asphalt Pavement Cap	3,100	SY	$22	$68,000
	c. Engineered Barrier Cap	3,500	SY	$53	$186,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$364,000
7	CONTINGENCY: (20% of construction capital cost)	20	%	$73,000	$73,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$440,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
8	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$90,000	$90,000
	b. Design and Contractor Procurement	1	LS	$50,000	$50,000
9	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$40,000	$40,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
10	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$220,000
11	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$55,000	$55,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$275,000**
	TOTAL CAPITAL COST:				**$715,000**

Alternative 4

PCB Impacted Soils Addressed with Asphalt Cap
(> 1 mg/kg and < 100 mg/kg) or Engineered Barrier (> 100 mg/kg)

Phase III RAP - OU 1 (Titleist Property)
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
12	O&M				
	a. Remedial Cap Monitoring and Documentation	1	LS	$5,000	$5,000
	b. Remedial Cap Maintenance and Repairs	1	LS	$2,000	$2,000
	Item Subtotal (Annual O&M)				$7,000
13	CONTINGENCY: (25% of O&M annual cost)	25	%	$2,000	$2,000
	TOTAL ANNUAL O&M COST:				**$9,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$177,000**	**$900,000**

Alternative 1

Monitored Subslab Soil Gas Attenuation

Phase III RAP - OU 2
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$2,000	$2,000
2	SITE PREPARATION	1	LS	$7,000	$7,000
3	SUBSLAB SOIL GAS MONITORING POINTS	1	LS	$5,000	$5,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$14,000
	CONTINGENCY: (25% of construction capital cost)	25	%	$4,000	$4,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$18,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
4	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$10,000	$10,000
	b Design and Contractor Procurement	1	LS	$10,000	$10,000
5	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$5,000	$5,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$10,000	$10,000
6	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$6,000	$6,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$61,000
	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$15,000	$15,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$76,000**
	TOTAL CAPITAL COST:				**$94,000**
	ANNUAL O&M COST				
7	O&M				
	a. 2 Rounds of Subslab Soil Gas Sampling (2 seasons)	2	EA	$5,000	$10,000
	b. 2 Rounds of Indoor Air Sampling (2 seasons)	2	EA	$5,000	$10,000
	c. 2 Rounds of Groundwater Sampling (2 seasons)	2	EA	$4,000	$8,000
	d. Semi-Annual Remedy Operation Status Reports	1	EA	$2,000	$2,000
	Item Subtotal (Annual O&M)				$30,000
	CONTINGENCY: (25% of O&M annual cost)	25	%	$8,000	$8,000
	TOTAL ANNUAL O&M COST:				**$38,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$745,000**	**$840,000**

Alternative 2

Vapor Barrier Over Floor Slab

Phase III RAP - OU 2
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$10,000	$10,000
2	SITE PREPARATION	1	LS	$7,000	$7,000
3	VAPOR BARRIER INSTALLATION	90,000	SF	$7	$630,000
4	SUBSLAB SOIL GAS MONITORING POINTS	1	LS	$5,000	$5,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$652,000
	CONTINGENCY: (25% of construction capital cost)	25	%	$163,000	$163,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$820,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
5	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$10,000	$10,000
	b Design and Contractor Procurement	1	LS	$85,000	$85,000
6	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	8	WK	$5,000	$40,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$10,000	$10,000
7	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$6,000	$6,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$171,000
	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$43,000	$43,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST				**$214,000**
	TOTAL CAPITAL COST:				**$1,100,000**
	ANNUAL O&M COST				
8	O&M				
	a. Vapor Barrier System Inspection and Documentation	1	LS	$5,000	$5,000
	b. Vapor Barrier System Maintenance and Repair	1	LS	$500	$500
	c Annual Subslab Soil Gas Sampling	1	LS	$5,000	$5,000
	d. Annual Indoor Air Sampling	1	LS	$5,000	$5,000
	e. Semi-Annual Remedy Operation Status Reports	1	LS	$6,000	$6,000
	Item Subtotal (Annual O&M)				$22,000
	CONTINGENCY: (25% of O&M annual cost)	25	%	$6,000	$6,000
	TOTAL ANNUAL O&M COST:				**$28,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$550,000**	**$1,700,000**

Alternative 3

Active Subslab Depressurization System

Phase III RAP - OU 2
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$10,000	$10,000
2	SITE PREPARATION	1	LS	$14,000	$14,000
3	ACTIVE SSDS INSTALLATION	90,000	SF	$5	$450,000
4	SUBSLAB SOIL GAS MONITORING POINTS	1	LS	$5,000	$5,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$479,000
	CONTINGENCY: (25% of construction capital cost)	25	%	$120,000	$120,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$600,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
5	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$10,000	$10,000
	b. Pre-Design Pilot Testing	1	LS	$100,000	$100,000
	c. Design and Contractor Procurement	1	LS	$85,000	$85,000
6	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$40,000	$40,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$10,000	$10,000
7	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$6,000	$6,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$271,000
	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$68,000	$68,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$339,000**
	TOTAL CAPITAL COST:				**$940,000**
	ANNUAL O&M COST				
8	O&M				
	a. Monthly Inspection and Differential Pressure Monitoring	1	LS	$6,000	$6,000
	c. SSDS Maintenance and Repairs	1	LS	$3,000	$3,000
	d Semi-Annual Remedy Operation Status Reports	1	LS	$7,000	$7,000
	Item Subtotal (Annual O&M)				$16,000
	CONTINGENCY: (25% of O&M annual cost)	25	%	$4,000	$4,000
	TOTAL ANNUAL O&M COST:				**$20,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$393,000**	**$1,340,000**

Alternative A1

Removal and Off-Site Disposal of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg

Phase III RAP - OU 3A
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$102,000	$102,000
2	SITE PREPARATION	1	LS	$64,000	$64,000
3	TEMPORARY FACILITIES AND CONTROLS	10	MONTH	$41,000	$410,000
4	ASPHALT & BUILDING FOUNDATION DEMOLITION				
	a. Former Building Area: Asphalt Pavement Removal & On-Site Consolidation	9,700	SY	$9	$87,000
	b. Former Building Area: Cover Fill Material Removal	8,500	CY	$15	$128,000
	c.. Former Building Area: Slab Demolition and On-Site Consolidation	45,700	SF	$2	$91,000
	d. 6" Asphalt Pavement Demolition and On-Site Consolidation	9,700	SY	$13	$126,000
5	STORM SEWER REPLACEMENT	1	LS	$170,000	$170,000
6	SOIL EXCAVATION				
	a. Soil Excavation and Management	25,600	CY	$20	$512,000
	b. Soil Segregation and Management for Re-Use Sampling	25,600	CY	$5	$128,000
	c. Excavation Support	24,500	SF	$40	$980,000
	d. Excavation Dewatering and Treatment	3	MONTH	$67,000	$201,000
7	TRANSPORTATION AND DISPOSAL OF EXCAVATED SOILS	41,000	TON	$275	$11,275,000
8	SITE RESTORATION				
	a. Reuse fill material from Building Foundation cover	17,100	CY	$40	$684,000
	b. Imported Clean Backfill	17,100	CY	$40	$684,000
	c. Cap Installation (demarcation layer, asphalt paving)	14,800	SY	$22	$326,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$15,970,000
9	CONTINGENCY: (15% of construction capital cost)	15	%	$2,396,000	$2,396,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$18,400,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
10	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$30,000	$30,000
	b. Design and Contractor Procurement	1	LS	$200,000	$200,000
11	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$400,000	$400,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$50,000	$50,000
12	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Status Report	1	LS	$8,000	$8,000
	b. Phase V Completion Statement	1	LS	$20,000	$20,000
	c. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$730,000
	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$183,000	$183,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$920,000**
	TOTAL CAPITAL COST:				**$19,400,000**

Alternative A1

Removal and Off-Site Disposal of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg

Phase III RAP - OU 3A
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
13	O&M				
	a. Cap Inspection and Documentation	1	LS	$15,000	$15,000
	b. Cap Maintenance and Repair	1	LS	$30,000	$30,000
	Item Subtotal (Annual O&M)				$45,000
	CONTINGENCY: (25% of O&M annual cost)	25	%	$11,000	$11,000
	TOTAL ANNUAL O&M COST:				**$60,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$1,177,000**	**$20,600,000**

Alternative A2

Ex-Situ Treatment of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg

Phase III RAP - OU 3A
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$137,000	$137,000
2	SITE PREPARATION	1	LS	$64,000	$64,000
3	TEMPORARY FACILITIES AND CONTROLS	24	MONTH	$41,000	$984,000
4	DEMOLITION BUILDING FOUNDATION				
	a. Former Building Area: Asphalt Pavement Removal & On-Site Consolidation	9,700	SY	$9	$87,000
	b. Former Building Area: Cover Fill Material Removal & On-Site Consolidation	8,500	CY	$15	$128,000
	c. Former Building Area: Slab Demolition and On-Site Consolidation	45,700	SF	$2	$91,000
	d. 6" Asphalt Pavement Demolition and On-Site Consolidation	9,700	SY	$13	$126,000
5	STORM SEWER REPLACEMENT	1	LS	$170,000	$170,000
6	SOIL EXCAVATION AND EX-SITU TREATMENT				
	a. Soil Excavation and Management	25,600	CY	$20	$512,000
	b. Soil Segregation and Re-use Sampling	25,600	CY	$0	$0
	c. Excavation Support	24,500	LS	$40	$980,000
	d. Excavation Dewatering and Treatment	3	MONTH	$67,000	$201,000
	e. Ex Situ Treatment	41,000	TON	$240	$9,840,000
7	SITE RESTORATION				
	a. Backfill with Treated Soils	25,600	CY	$10	$256,000
	b. Cap Installation (demarcation layer, asphalt paving)	14,800	SY	$22	$326,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$13,900,000
8	CONTINGENCY: (25% of construction capital cost)	20	%	$2,780,000	$2,780,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$16,700,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
9	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$30,000	$30,000
	b. Design and Contractor Procurement	1	LS	$200,000	$200,000
10	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$360,000	$360,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$50,000	$50,000
11	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Status Report	1	LS	$8,000	$8,000
	b. Phase V Completion Statement	1	LS	$20,000	$20,000
	c. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$690,000
	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$173,000	$173,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$870,000**
	TOTAL CAPITAL COST:				**$17,600,000**

Alternative A2

Ex-Situ Treatment of Soils Above UCLs and Cap Areas With PCB Concentrations > 2 mg/kg

Phase III RAP - OU 3A
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
12	O&M				
	a. Cap Inspection and Documentation	1	LS	$15,000	$15,000
	b. Cap Maintenance and Repair	1	LS	$30,000	$30,000
	Item Subtotal (Annual O&M)				$45,000
	CONTINGENCY: (25% of annual O&M cost)	25	%	$11,000	$11,000
	TOTAL ANNUAL O&M COST:				**$60,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$1,177,000**	**$18,800,000**

Alternative A3

Asphalt Cap Over Soils With PCB Concentrations > 2 mg/kg and Engineered Barrier Over Soils With Concentrations Above UCLs

Phase III RAP - OU 3A
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$55,000	$55,000
2	SITE PREPARATION	1	LS	$64,000	$64,000
3	TEMPORARY FACILITIES AND CONTROLS	4	MONTH	$41,000	$164,000
4	ASPHALT PAVEMENT REMOVAL AND ON-SITE CONSOLIDATION	9,700	SY	$13	$126,000
5	STORM SEWER REPLACEMENT	1	LS	$170,000	$170,000
6	ENGINEERED BARRIER CAP				
	a. Within Former Building Footprint	5,100	SY	$18	$92,000
	b. Outside Former Building Footprint	9,700	SY	$50	$485,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$1,160,000
7	CONTINGENCY: (25% of construction capital cost)	25	%	$290,000	$290,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$1,500,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
8	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$30,000	$30,000
	b. Design and Contractor Procurement	1	LS	$75,000	$75,000
9	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$160,000	$160,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$50,000	$50,000
10	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Status Report	1	LS	$8,000	$8,000
	b. Phase V Completion Statement	1	LS	$20,000	$20,000
	c. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$360,000
11	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$90,000	$90,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$450,000**
	TOTAL CAPITAL COST:				**$2,000,000**
	ANNUAL O&M COST				
12	O&M				
	a. Cap Inspection and Documentation	1	LS	$15,000	$15,000
	b. Cap Maintenance and Repair	1	LS	$30,000	$30,000
	Item Subtotal (Annual O&M)				$45,000
13	CONTINGENCY: (25% of O&M annual cost)	25	%	$11,000	$11,000
	TOTAL ANNUAL O&M COST:				**$60,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$1,177,000**	**$3,200,000**

Alternative 1

Containment Via Vertical Barrier Wall

Phase III RAP - OU 3B
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$50,000	$50,000
2	SITE PREPARATION	1	LS	$172,000	$172,000
3	TEMPORARY FACILITIES AND CONTROLS	3	MONTH	$33,000	$99,000
4	IMPERMEABLE BARRIER WALL	47,900	SF	$25	$1,198,000
5	CONDITIONING, TRANSPORTATION AND DISPOSAL OF SPOILS	510	TON	$88	$45,000
6	SITE RESTORATION	6,670	SY	$24	$160,000
7	COMPLIANCE MW INSTALLATION	1	LS	$25,000	$25,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$1,749,000
8	CONTINGENCY: (25% of construction capital cost)	25	%	$437,000	$437,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$2,200,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
9	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$40,000	$40,000
	b. Design and Contractor Procurement	1	LS	$70,000	$70,000
10	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$180,000	$180,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
11	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$330,000
12	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$83,000	$83,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST				**$420,000**
	TOTAL CAPITAL COST:				**$2,700,000**
	ANNUAL O&M COST				
13	O&M				
	a. Quarterly Groundwater Monitoring and Reporting	4	EA	$19,000	$76,000
	Item Subtotal (Annual O&M)				$76,000
	CONTINGENCY: (25% of O&M annual cost)	25	%	$19,000	$19,000
	TOTAL ANNUAL O&M COST:				**$95,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$1,863,000**	**$4,600,000**

Alternative 2

Containment via Vertical Barrier Wall and Hydraulic Containment

Phase III RAP - OU 3B
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION				
	a. Barrier Wall Installation Contractor	1	LS	$50,000	$50,000
	b. Groundwater Treatment Plant Installer	1	LS	$50,000	$50,000
2	SITE PREPARATION	1	LS	$101,000	$101,000
3	TEMPORARY FACILITIES AND CONTROLS	5	MONTH	$33,000	$165,000
4	IMPERMEABLE BARRIER WALL	47,900	SF	$25	$1,198,000
5	CONDITIONING, TRANSPORTATION AND DISPOSAL OF SPOILS	510	TON	$88	$45,000
6	GROUNDWATER PUMP/TREAT SYSTEM				
	a. Groundwater Pumping Wells	5	EACH	$46,000	$230,000
	b. Groundwater Extraction Conveyance	1,200	LF	$150	$180,000
	c Outdoor Tank Area	1	LS	$134,000	$134,000
	d. Groundwater Treatment System	1	LS	$720,000	$720,000
	e. Treatment Building	2,400	SF	$125	$300,000
	f. Effluent Discharge Conveyance	1	LS	$50,000	$50,000
	g. Utilities to Treatment Building	1	LS	$90,000	$90,000
7	SITE RESTORATION	6,670	SY	$24	$160,000
8	COMPLIANCE MW INSTALLATION	1	LS	$25,000	$25,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$3,498,000
9	CONTINGENCY: (25% of construction capital cost)	25	%	$875,000	$875,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$4,380,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
10	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$40,000	$40,000
	b. Design and Contractor Procurement	1	LS	$150,000	$150,000
11	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$300,000	$300,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
12	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$530,000
13	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$133,000	$133,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$663,000**
	TOTAL CAPITAL COST:				**$5,100,000**

Alternative 2

Containment via Vertical Barrier Wall and Hydraulic Containment

Phase III RAP - OU 3B
Former Aerovox Facility

Item	Cost Component		Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST					
14	O&M					
	a.	Quarterly Groundwater Monitoring and Reporting	4	EA	$19,000	$76,000
	b.	Operation and Maintenance	1	LS	$375,000	$375,000
	c.	Annual Electric Costs	1,314,000	kW-Hr	$0.20	$263,000
	d.	POTW Discharge Fees	34,164,000	gal	$0.003	$85,000
		Item Subtotal (Annual O&M)				$799,000
	CONTINGENCY: (25% of O&M annual cost)		25	%	$200,000	$200,000
	TOTAL ANNUAL O&M COST:					**$999,000**
	TOTAL PRESENT NET WORTH					
			Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	20 - Year Present Worth		3%	20	**$14,863,000**	**$20,000,000**

Alternative 3

Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination

Phase III RAP - OU 3B
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION				
	a. Barrier Wall Installation Contractor	1	LS	$50,000	$50,000
	b. In Situ Treatment Contractor	1	LS	$15,000	$15,000
	c. Groundwater Treatment Plant Installer	1	LS	$50,000	$50,000
2	SITE PREPARATION	1	LS	$101,000	$101,000
3	TEMPORARY FACILITIES AND CONTROLS	6	MONTH	$33,000	$198,000
4	IMPERMEABLE BARRIER WALL	47,900	SF	$25	$1,198,000
5	CONDITIONING, TRANSPORTATION AND DISPOSAL OF SPOILS	270	CY	$88	$24,000
6	IN SITU TREATMENT				
	a. Reagent Raw Materials	394,700	LB	$1.65	$651,000
	b. Two Rounds of Reagent Injections	1	LS	$358,000	$358,000
7	GROUNDWATER PUMP/TREAT SYSTEM				
	a. Groundwater Pumping Wells	5	EACH	$46,000	$230,000
	b. Groundwater Extraction Conveyance	1,200	LF	$250	$300,000
	c Outdoor Tank Area	1	LS	$134,000	$134,000
	d. Groundwater Treatment System	1	LS	$720,000	$720,000
	e. Treatment Building	2,400	SF	$125	$300,000
	f. Effluent Discharge Conveyance	1	LS	$50,000	$50,000
	g. Utilities to Treatment Building	1	LS	$90,000	$90,000
8	SITE RESTORATION	6,670	SY	$24	$160,000
9	COMPLIANCE MW INSTALLATION	1	LS	$25,000	$25,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$4,654,000
10	CONTINGENCY: (25% of construction capital cost)	25	%	$1,164,000	$1,164,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$5,900,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
11	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$40,000	$40,000
	b. Treatability/Field Pilot Testing	1	LS	$70,000	$70,000
	c. Design and Contractor Procurement	1	LS	$150,000	$150,000
12	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$360,000	$360,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
13	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$660,000
14	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$165,000	$165,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$825,000**
	TOTAL CAPITAL COST:				**$6,800,000**

Alternative 3

Containment via Vertical Barrier Wall with Hydraulic Containment and In-Situ Treatment of Soils Acting as a Source to Groundwater Contamination

Phase III RAP - OU 3B
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
15	O&M				
	a. Quarterly Groundwater Monitoring and Reporting	4	EA	$19,000	$76,000
	b. Operation and Maintenance	1	LS	$375,000	$375,000
	c. Annual Electric Costs	1,314,000	kW-Hr	$0.20	$263,000
	d. POTW Discharge Fees	34,164,000	gal	$0.003	$85,000
	Item Subtotal (Annual O&M)				$799,000
16	CONTINGENCY: (25% of O&M annual cost)	25	%	$200,000	$200,000
	TOTAL ANNUAL O&M COST:				**$999,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	10 - Year Present Worth	3%	10	**$8,522,000**	**$15,400,000**

Alternative 4

Containment via Vertical Barrier Wall and Permeable Reactive Barrier

Phase III RAP - OU 3B
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION/DEMOBILIZATION				
	a. Dewind Trenching Contractor	1	LS	$65,000	$65,000
	b. Media Mixing Support Contractor	1	LS	$20,000	$20,000
	c. Barrier Wall Installation Contractor	1	LS	$50,000	$50,000
2	SITE PREPARATION	1	LS	$101,000	$101,000
3	TEMPORARY FACILITIES AND CONTROLS	3	MONTH	$33,000	$99,000
4	VERTICAL BARRIER WALL				
	a. Impermeable Barrier Wall	24,100	SF	$25	$603,000
	b. Continuous Trenched Permeable Reactive Barrier Installation	16,600	SF	$56	$930,000
	c. Permeable Reactive Barrier Media (Sand)	1,900	tons	$60	$114,000
	d Permeable Reactive Barrier Media (Carbon)	443,300	lb	$1.50	$665,000
	e Permeable Reactive Barrier Media (ZVI)	230	tons	$1,000	$230,000
	f Reactive media mixing contractor	1	LS	$148,800	$149,000
	g In-situ injections of hot spots	1	LS	$302,700	$303,000
5	CONDITIONING, TRANSPORTATION AND DISPOSAL OF SPOILS	1,800	TON	85	$153,000
6	SITE RESTORATION	6,670	SY	24	$160,000
7	COMPLIANCE MW INSTALLATION	1	LS	$25,000	$25,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$3,667,000
8	CONTINGENCY: (25% of construction capital cost)	25	%	$917,000	$917,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$4,600,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
9	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$40,000	$40,000
	b. Treatability Study (column testing)	1	LS	$35,000	$35,000
	c. Design and Contractor Procurement	1	LS	$100,000	$100,000
10	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$180,000	$180,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
11	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$395,000
12	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$99,000	$99,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$500,000**
	TOTAL CAPITAL COST:				**$5,100,000**

Alternative 4

Containment via Vertical Barrier Wall and Permeable Reactive Barrier

Phase III RAP - OU 3B
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	ANNUAL O&M COST				
13	O&M				
	a. Quarterly Groundwater Monitoring and Reporting	4	EA	$24,180	$96,720
	Item Subtotal (Annual O&M)				$96,720
14	CONTINGENCY: (25% of O&M annual cost)	25	%	$24,000	$24,000
	TOTAL ANNUAL O&M COST:				**$121,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	10 - Year Present Worth	3%	10	**$1,033,000**	**$6,200,000**

Alternative 1

In-Situ Chemical Oxidation of Hot Spots and Monitored Natural Attenuation

Phase III RAP - OU 4
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	4	ea	$ 15,000	$60,000
2	WELL DECOMMISSIONING	36	EACH	$1,000	$36,000
3	NEW MONITORING WELLS (IF NEEDED)				
	a. 3 Wells per Hotspot Group	2	EACH	$20,000	$40,000
4	IN SITU CHEMICAL OXIDATION OF HOT SPOTS				
	a. Injection and Extraction Well Installation	1,550	LF	$275	$426,000
	b. Oxidant/Reagent Raw Materials	303,000	LB	$2.01	$609,000
	c. Injection and Pulsed Recirculation	1	LS	$916,000	$916,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$2,087,000
5	CONTINGENCY: (25% of construction capital cost)	25	%	$522,000	$522,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$2,609,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
6	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$25,000	$25,000
	b. Treatability/Field Pilot Testing	1	LS	$70,000	$70,000
	c. Design and Contractor Procurement	1	LS	$100,000	$100,000
7	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$120,000	$120,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
8	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$355,000
9	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$89,000	$89,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST:				**$444,000**
	TOTAL CAPITAL COST:				**$3,100,000**
	ANNUAL O&M COST				
10	O&M				
	a. Groundwater Monitoring and Reporting	1	LS	$27,000	$27,000
	Item Subtotal (Annual O&M)				$27,000
11	CONTINGENCY: (25% of O&M annual cost)	25	%	$7,000	$7,000
	TOTAL ANNUAL O&M COST:				**$34,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$667,000**	**$3,800,000**

Alternative 2

In-Situ Thermal Treatment of Deep Bedrock Hot Spots, In-Situ Chemical Oxidation of Shallow Bedrock Hot Spots and Monitored Natural Attenuation

Phase III RAP - OU 4
Former Aerovox Facility

Item	Cost Component	Quantity	Units	Unit Costs	Line Item Costs
	CONSTRUCTION CAPITAL COST				
1	MOBILIZATION & DEMOBILIZATION	1	LS	$ 168,000	$168,000
2	WELL DECOMMISSIONING	36	EACH	$1,000	$36,000
3	NEW MONITORING WELLS				
	a. 3 Wells per Hotspot Group	2	EACH	$20,000	$40,000
4	IN SITU TREATMENT OF HOT SPOTS				
	a. Thermal Treatment (Deep Bedrock)	60,100	CY	$132	$7,933,200
	b. Chemical Oxidation (Shallow Bedrock)				
	i. Injection Well Installation	140	LF	$275	$39,000
	ii. Oxidant/Reagent Raw Materials	122,000	LB	$1.27	$155,000
	iii. Injection and Pulsed Recirculation	1	LS	$201,300	$201,000
	SUBTOTAL CONSTRUCTION CAPITAL COST:				$8,572,000
5	CONTINGENCY: (25% of construction capital cost)	25	%	$2,143,000	$2,143,000
	TOTAL CONSTRUCTION CAPITAL COST:				**$10,715,000**
	ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST				
6	PRE-CONSTRUCTION ENGINEERING AND PERMITTING				
	a. Remedial Implementation Plan	1	LS	$25,000	$25,000
	b. Treatability/Field Pilot Testing	1	LS	$70,000	$70,000
	c. Design and Contractor Procurement	1	LS	$100,000	$100,000
7	CONSTRUCTION SUPPORT, OBSERVATION AND DOCUMENTATION				
	a. Construction Observation & Quality Assurance	1	LS	$90,000	$90,000
	b. Phase IV Completion Report, As-builts, Remedy Operation Status & Final Inspection Reports	1	LS	$15,000	$15,000
8	POST-CONSTRUCTION DOCUMENTATION				
	a. Phase V Completion Statement	1	LS	$5,000	$5,000
	b. AUL to Restrict Site Use	1	LS	$20,000	$20,000
	SUBTOTAL ENGINEERING, PERMITTING, AND DOCUMENTATION CAPITAL COST:				$325,000
9	CONTINGENCY: (25% of engineering and permitting capital cost)	25	%	$81,000	$81,000
	TOTAL ENGINEERING, PERMITTING AND DOCUMENTATION CAPITAL COST				**$406,000**
	TOTAL CAPITAL COST:				**$11,200,000**
	ANNUAL O&M COST				
10	O&M				
	a. Groundwater Monitoring and Reporting	1	LS	$27,000	$27,000
	Item Subtotal (Annual O&M)				$27,000
11	CONTINGENCY: (25% of O&M annual cost)	25	%	$7,000	$7,000
	TOTAL ANNUAL O&M COST:				**$34,000**
	TOTAL PRESENT NET WORTH				
		Yearly Interest Rate	**Number Years**	**O&M Present Worth**	**Total Present Worth**
	30 - Year Present Worth	3%	30	**$667,000**	**$11,900,000**

Appendix E: Notifications

1 Tech Drive, Suite 310
Andover, MA 01810-2435

T: 978.794.0336
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Brown AND Caldwell

August 22, 2016

Mr. Jonathan F. Mitchell, Mayor
City of New Bedford
133 William Street
New Bedford, MA 02740

Project Number: 149339

Subject: Notification of Phase III Remedial Action Plan
Former Aerovox Facility
740 Belleville Avenue, New Bedford, Massachusetts
Release Tracking Number (RTN) 4-0601

Honorable Mayor Mitchell:

On behalf of AVX Corporation (AVX) and as required by the Massachusetts Contingency Plan (MCP) subpart 310 CMR 40.1403(3)(e), this letter is notification to the Chief Municipal Officer and Board of Health of the submittal of a Phase III Remedial Action Plan (Phase III) for the above-referenced Site. The Phase III Report is being submitted to the Massachusetts Department of Environmental Protection (MassDEP) in accordance with the MCP, pursuant to 310 CMR 40.0850, and the provisions of an Administrative Consent Order between AVX and MassDEP.

The Phase III report will be filed electronically, and may be accessed by searching for the referenced RTN number on the MassDEP web site: http://public.dep.state.ma.us/SearchableSites2/Search.aspx. The full report may also be reviewed by contacting the Southeast Regional Office of MassDEP located at 20 Riverside Drive in Lakeville, Massachusetts. For information about accessing files for review, contact the MassDEP file review coordinator at (508) 946-2718 or submit a file review request online at http://www.mass.gov/eea/agencies/massdep/about/contacts/southeast-region-file-review-and-public-records-request.html

Based on the results of the Phase III RAP evaluation, the following findings and conclusions are presented:

1. For the purpose of evaluating remedial actions, the site has been divided into four operable units (OUs) based on the media and identified exposure pathways where the Method 3 Risk Characterization identified the presence of Significant Risk to human health and/or the environment and a Risk to Public Welfare. The OUs are identified as OU1 through OU4 and include:
   - OU1 - Uncapped soils impacted by PCBs between the ground surface and an identified peat layer on the east end of the Titleist property;

- OU2 - Vapor intrusion associated with CVOC contaminated groundwater in shallow overburden in Hadley Street adjacent to Precix;
- OU3 – Aerovox source area including overburden soil (OU3A) and groundwater (OU3B) contaminants (sources), and
- OU4 – Bedrock groundwater.

2. Remedial technologies for various site media were screened for further evaluation as potential remedial action alternatives including:
   - Soil
     - Treatment (in-situ and ex-situ)
     - Containment
     - Excavation and off-site disposal or on-site consolidation of impacted soils
     - Activity and Use Limitation (AUL)
   - Groundwater:
     - Treatment (in-situ, ex-situ and permeable reactive barrier)
     - Containment
   - Soil Gas/Indoor Air
     - Monitored attenuation
     - Vapor barrier
     - Sub-slab depressurization system
     - AUL
   - Dense Non-Aqueous Phase Liquid (DNAPL)
     - Free product recovery and off-site disposal
     - Excavation
   - Sewer Line Contaminants
     - Removal and replacement
     - Cleaning and re-lining

3. Between two and four remedial action alternatives were formulated for each of the identified site media, which included one or more remedial technologies that would result in reaching the remedial goals for each OU. Each of the alternatives were evaluated based on effectiveness, reliability, implementability, cost, risk, benefits, timeliness, non-pecuniary considerations and sustainable remediation.

4. The selected remedial action alternatives for the four OUs are:
   - OU1 – Removal and off-site disposal or consolidation: The selected alternative includes excavation of the top 2 feet of soil with PCB concentrations greater than 1 milligram per kilogram (mg/kg) and deeper soils with PCB concentrations greater than the PCB UCL of 100 mg/kg. Excavated soils will be disposed at an off-site licensed facility. An AUL will be recorded for the

property to restrict foreseeable future uses of the area. This remedy is estimated to take three months to implement.

- OU2 – Precix Property Vapor Intrusion: The selected alternative includes an AUL, monitoring of sub-slab soil gas and indoor air within the area of concern on the Precix property, and monitoring of groundwater chlorinated volatile organic compounds (CVOCs). An AUL will be placed on the property to restrict foreseeable future building uses to those activities and uses that would result in no greater exposure of occupants to indoor air than the current use. Under existing conditions and current site use a condition of No Significant Risk exists, so the selected alternative is targeted to address potential changes in future conditions or uses. This remedy will remain in effect until attenuation demonstrates vapor intrusion related restrictions are no longer required.
- OU3A and OU3B – Aerovox Source Area Overburden Soils and Groundwater: An engineered barrier and asphalt cap will be constructed over soils impacted with contamination greater than UCLs and PCBs greater than 2 mg/kg, respectively. An AUL will be placed on the property to restrict current and foreseeable future uses and activities. The selected remedy for groundwater includes in-situ treatment of plume hot spots, installation of a permeable reactive barrier on the east (downgradient) side of the site, and installation of vertical barrier walls along the north and south sides of the site. The vertical walls and permeable reactive barrier will extend into bedrock. Subsequent to installation of the barrier system, a monitoring program will be initiated to evaluate containment and treatment of the source area. Construction of the engineered barrier and asphalt cap is estimated to be completed in four months. The in-situ groundwater treatment and barrier wall system will operate an estimated 10 years to achieve remedial goals.
- OU4 – Site-Wide Bedrock Groundwater: the selected remedial action alternative for this OU is in-situ chemical oxidation of fractured bedrock groundwater hot spots. Subsequent to treatment, a groundwater monitoring program will be implemented to monitor natural attenuation. Achieving remedial goals in the hot spot areas is estimated to take three to four years.

5. Implementation of these remedial measures will lead to closure of the site with a Permanent Solution. It is anticipated that the site will be maintained in Remedy Operation Status for up to 10 years before conditions supporting a Permanent Solution are achieved.

If you have any questions regarding the Phase III Remedial Action Plan findings and conclusions, please contact the undersigned at 978-983-2055.

Very truly yours,

Brown and Caldwell

Marilyn Wade

Marilyn Wade, PE, LSP, Project Manager
Andover, Massachusetts

cc: Brenda Weis, Director, City of New Bedford Board of Health
Michele Paul, Director, City of New Bedford Department of Environmental Stewardship
Evan Slavitt, Vice President, AVX Corporation

1 Tech Drive, Suite 310
Andover, MA 01810-2435

T: 978.794.0336
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August 22, 2016

Brenda Weis, Director
City of New Bedford Board of Health
1213 Purchase Street
New Bedford, MA 02740

Project Number: 149339

Subject: Notification of Phase III Remedial Action Plan
Former Aerovox Facility
740 Belleville Avenue, New Bedford, Massachusetts
Release Tracking Number (RTN) 4-0601

Dear Director Weis:

On behalf of AVX Corporation (AVX) and as required by the Massachusetts Contingency Plan (MCP) subpart 310 CMR 40.1403(3)(e), this letter is notification to the Chief Municipal Officer and Board of Health of the submittal of a Phase III Remedial Action Plan (Phase III) for the above-referenced Site. The Phase III Report is being submitted to the Massachusetts Department of Environmental Protection (MassDEP) in accordance with the MCP, pursuant to 310 CMR 40.0850, and the provisions of an Administrative Consent Order between AVX and MassDEP.

The Phase III report will be filed electronically, and may be accessed by searching for the referenced RTN number on the MassDEP web site: http://public.dep.state.ma.us/SearchableSites2/Search.aspx. The full report may also be reviewed by contacting the Southeast Regional Office of MassDEP located at 20 Riverside Drive in Lakeville, Massachusetts. For information about accessing files for review, contact the MassDEP file review coordinator at (508) 946-2718 or submit a file review request online at http://www.mass.gov/eea/agencies/massdep/about/contacts/southeast-region-file-review-and-public-records-request.html

Based on the results of the Phase III RAP evaluation, the following findings and conclusions are presented:

1. For the purpose of evaluating remedial actions, the site has been divided into four operable units (OUs) based on the media and identified exposure pathways where the Method 3 Risk Characterization identified the presence of Significant Risk to human health and/or the environment and a Risk to Public Welfare. The OUs are identified as OU1 through OU4 and include:
    - OU1 - Uncapped soils impacted by PCBs between the ground surface and an identified peat layer on the east end of the Titleist property;

- OU2 - Vapor intrusion associated with CVOC contaminated groundwater in shallow overburden in Hadley Street adjacent to Precix;
- OU3 – Aerovox source area including overburden soil (OU3A) and groundwater (OU3B) contaminants (sources), and
- OU4 – Bedrock groundwater.

2. Remedial technologies for various site media were screened for further evaluation as potential remedial action alternatives including:
   - Soil
     Treatment (in-situ and ex-situ)
     Containment
     Excavation and off-site disposal or on-site consolidation of impacted soils
     Activity and Use Limitation (AUL)
   - Groundwater:
     Treatment (in-situ, ex-situ and permeable reactive barrier)
     Containment
   - Soil Gas/Indoor Air
     Monitored attenuation
     Vapor barrier
     Sub-slab depressurization system
     AUL
   - Dense Non-Aqueous Phase Liquid (DNAPL)
     Free product recovery and off-site disposal
     Excavation
   - Sewer Line Contaminants
     Removal and replacement
     Cleaning and re-lining

3. Between two and four remedial action alternatives were formulated for each of the identified site media, which included one or more remedial technologies that would result in reaching the remedial goals for each OU. Each of the alternatives were evaluated based on effectiveness, reliability, implementability, cost, risk, benefits, timeliness, non-pecuniary considerations and sustainable remediation.

4. The selected remedial action alternatives for the four OUs are:
   - OU1 – Removal and off-site disposal or consolidation: The selected alternative includes excavation of the top 2 feet of soil with PCB concentrations greater than 1 milligram per kilogram (mg/kg) and deeper soils with PCB concentrations greater than the PCB UCL of 100 mg/kg. Excavated soils will be disposed at an off-site licensed facility. An AUL will be recorded for the property to restrict foreseeable future uses of the area. This remedy is estimated to take three months to implement.

- OU2 – Precix Property Vapor Intrusion: The selected alternative includes an AUL, monitoring of sub-slab soil gas and indoor air within the area of concern on the Precix property, and monitoring of groundwater chlorinated volatile organic compounds (CVOCs). An AUL will be placed on the property to restrict foreseeable future building uses to those activities and uses that would result in no greater exposure of occupants to indoor air than the current use. Under existing conditions and current site use a condition of No Significant Risk exists, so the selected alternative is targeted to address potential changes in future conditions or uses. This remedy will remain in effect until attenuation demonstrates vapor intrusion related restrictions are no longer required.
- OU3A and OU3B – Aerovox Source Area Overburden Soils and Groundwater: An engineered barrier and asphalt cap will be constructed over soils impacted with contamination greater than UCLs and PCBs greater than 2 mg/kg, respectively. An AUL will be placed on the property to restrict current and foreseeable future uses and activities. The selected remedy for groundwater includes in-situ treatment of plume hot spots, installation of a permeable reactive barrier on the east (downgradient) side of the site, and installation of vertical barrier walls along the north and south sides of the site. The vertical walls and permeable reactive barrier will extend into bedrock. Subsequent to installation of the barrier system, a monitoring program will be initiated to evaluate containment and treatment of the source area. Construction of the engineered barrier and asphalt cap is estimated to be completed in four months. The in-situ groundwater treatment and barrier wall system will operate an estimated 10 years to achieve remedial goals.
- OU4 – Site-Wide Bedrock Groundwater: the selected remedial action alternative for this OU is in-situ chemical oxidation of fractured bedrock groundwater hot spots. Subsequent to treatment, a groundwater monitoring program will be implemented to monitor natural attenuation. Achieving remedial goals in the hot spot areas is estimated to take three to four years.

5. Implementation of these remedial measures will lead to closure of the site with a Permanent Solution. It is anticipated that the site will be maintained in Remedy Operation Status for up to 10 years before conditions supporting a Permanent Solution are achieved.

If you have any questions regarding the Phase III Remedial Action Plan findings and conclusions, please contact the undersigned at 978-983-2055.

Very truly yours,

Brown and Caldwell

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cc: Jonathan F. Mitchell, Mayor, City of New Bedford